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FOREWORD

The contemporary stage in the advance of the Soviet economy is that of developed socialism. It is characterised by the undivided supremacy of socialist production relations, a high level of production, application of the achievements of the scientific and technological revolution in building the material and technical base of communism, a rising standard of living of the working people and growing co-operation with other countries, be they socialist, developing or capitalist, and by the development and spread of Marxist-Leninist theory—the ideological foundation for the creative activities of the people.

The 25th Congress of the Communist Party has contributed much new to economic science and practice. The Congress analysed the achievements of the USSR's economy and its surviving shortcomings. The need for a comprehensive, target-oriented approach to planning was substantiated. The orientation on the final economic result formulated in the report of the CPSU Central Committee is of major importance for the further development of the economy. The tasks involved in promoting Group B industries in order to ensure a rise in the level of consumption were presented as particularly pressing. The question of the development of the infrastructure—both productive and social—arose for the first time at the Congress. The economic aspects of production activities and the task of environmental protection were once again emphasised. All the Congress documents and the "Guidelines for the Development of the National Economy of the USSR for 1976-1980" adopted

by it emphasise the task of mobilising the considerable internal reserves within the economy—manpower, materials and production funds.

Analysis of the economy of the USSR today and generalisation of that which is taking place within it both enrich and develop theory. Of particular importance are the multi-faceted aspects of raising the efficiency of socialist production—the economic, socio-political, scientific, technical and historical aspects, the content of efficiency and ways of defining it and raising its level.

It is not possible for a single work to cover all the major political and economic aspects of socialist society, from the development of the forms of ownership and changes in the nature of labour and the social structure of society to the significance of external economic ties. These can only be considered partially, in so far as they concern economic growth, the main content of this book.

The issues raised in the book are considered starting with an analysis of the high level of growth of productive forces attained in the USSR, socio-economic development, and also shortcomings and imbalances, the elimination of which is a precondition for speeding up economic growth. Then the mechanism of economic management determined by the advantages of socialism and its laws is described—national economic planning, its improvement and tasks for the future, the development of organisational forms for managing the economy, improving the operation of economic levers of management, including the use of commodity-money relations. Among the advantages engendered by the socialist forms of ownership, the new attitude to work instilled in man by communist education is considered.

The book goes on to analyse the resources available for the Soviet people, including (1) the population and labour resources, (2) natural productive forces, and (3) the productive and non-productive assets created by the Soviet people. It is a matter of ways to improve the utilisation of these resources at the existing level of socio-economic development in the USSR and their role in the further growth of the socialist economy on the road towards communism.

The motive forces behind economic growth include the welfare of the Soviet people. An increase in the population's standard of living is the goal of socialism and the result of all the advantages of the socialist economy. For this reason, this issue might be considered as the culminating section of this book. Along with the level of welfare however, the socialist way of life is also one of the major factors governing economic growth and the utilisation of resources in the economy. This constitutes an extremely important condition for raising the productivity of labour and the efficiency of social production. In order for the increasingly complex technology of contemporary production to be utilised successfully, a highly trained labour force is required. Skilled workers are just as necessary as up-to-date equipment which must be mastered and operated to capacity. All this explains the role ascribed in the book to raising the material and cultural level of the working people.

At the present time, precise ways of intensifying production, utilising the major internal reserves for economic growth, both labour and materials, raising the productivity of labour, reducing the amount of material used per unit of output and the assets-output ratio are acquiring great importance. These reserves are considerable and the possibilities for utilising them are great; it is important to determine the methods by which they can be most fully used.

The main factor in raising the efficiency of social production is scientific and technological progress. During the years of Soviet power, considerable success has been achieved in the development of science and technology, and in many fields the Soviet Union has come to the fore. Much more is still to be done, however, to resolve the task of combining the achievements of the scientific and technological revolution with the advantages of socialism and of thus creating the most favourable conditions for speeding up economic growth, and for achieving the highest level of production and consumption in the world. For a more precise and, at the same time, more comprehensive consideration of the specific features of the development of the socialist economy, contemporary tasks involved in the de-

velopment of the branches of the national economy are studied in the book. Individual chapters are devoted to industry, agriculture, transport and construction.

The book ends with an analysis of the growth of the national income as the summary indicator of the development of the national economy and, at the same time, as the material basis for raising the people's standard of living. The book proposes the ratio of effect to the overall sum of consumed and applied social labour as an indicator of the efficiency of social production.

CHAPTER I

THE CONTEMPORARY LEVEL OF DEVELOPMENT OF PRODUCTION IN THE USSR

1. LEVELS AND RATES OF DEVELOPMENT

The socialist economy is characterised by fast rates of development that outstrip those of capitalism and other previous social systems. This rapid economic growth is a result of the advantages of the socialist economy, that is, social ownership of the means of production, development of production in the interests of the whole of society, and planning of the national economy. These factors make it possible to concentrate all resources and manpower on achieving the set targets and selecting optimal development paths and also to maintain the necessary balances.

Since the Great October Socialist Revolution in 1917, the Soviet Union has passed through several stages in building a communist society. In the mid-1930s, the transitional period in the country came to an end, the capitalist structure within the economy was completely eliminated and the proportion of individual holdings became negligible. On the whole a socialist society had been built. Following victory in the Great Patriotic War of 1941-1945 and the completion of the period of reconstruction, new successes were gained in the development of the economy and further transformation of society. By its fiftieth anniversary, the Soviet Union had risen to a new historical stage, that of developed socialism.

What are the characteristic features of this stage?

Above all, there is a high level of production. The present level of production, its rate of growth and structure are also decisive for the further building of a communist

society. When considering the growth of material production and trends within it, it is most important to reveal its sources, directions and rates. The sources of this growth at the stage of developed socialism are intensification of production, utilisation of the significant internal resources in production by raising the productivity of labour and reducing material and capital input-output ratio. Considerable significance attaches to acceleration of scientific and technological progress and combining its achievements with the advantages of socialism.

A major characteristic of developed socialism is that attention is turned to raising the living standards of the population in every possible way. The people's welfare has risen. Culture and science are flourishing and a high level of education and skills has been achieved among the people. This all became possible thanks to the successful development of the economy. At the same time there is a beneficial feed-back from the increase in welfare to production, through a rise in labour productivity.

On this basis, during the period of developed socialism changes take place in production relations. The level of socialisation of production has risen thanks to the growth in fixed assets and their renewal, to concentration of production, the establishment of associations in industry and creation of agro-industrial complexes, and to the strengthening and expansion of the technical base of state and collective farms. The steady growth of production helps to eliminate any essential differences between town and country, while the increase in the people's level of culture and education helps, in conjunction with technological progress, to eliminate such differences between mental and physical labour. During the period of developed socialism, conservation of the natural environment acquires particular significance for ensuring better living conditions for the people and more rational use of natural resources.

High economic growth rates are facilitated by the existence of the world socialist system, economic integration between the socialist countries, and co-operation and division of labour between them.

As socialist society advances towards communism, the planned nature of development acquires increasing signif-

icance as one of the advantages of socialism. The growth of socialist production, the increase in its proportions, the increasing complexity of the links, and technological progress, all necessitate an improvement in the planning system and a closer contact between it and production. The widespread use of economico-mathematical methods and of computers makes it possible to achieve a higher degree of precision in plans and select the best versions. Long-term plans and forecasts are coming into increasing use. Planning must be oriented on the final economic results, as intermediate products are no more than a means of obtaining the final product. In this connection, the task involved in planning is to study requirements, demand and changes in consumption patterns and then meet requirements. To strengthen planning, not only should industry and territorial plans be co-ordinated, but also ever increasing use made of the target-oriented approach to the compilation of plans. As a result, the importance of the composite nature of planning and economic development increases.

Self-sufficiency must be further developed as a method for managing the socialist economy and as one of the main instruments for achieving plan fulfilment. The increasing effect of economic stimulation is intended to serve as an incentive to produce the goods the consumer needs, in sufficient quantities and of high quality. The price formation system is being improved to react more flexibly and rapidly to changes in demand and to new production requirements, while remaining centralised. Both short and long-term crediting must be applied widely, and free financing of capital construction must cease in the majority of cases.

One important feature of developed socialism is that economic development in the republics and regions of the USSR is levelled out and the distribution of productive forces is improved. Modern large-scale industry and a ramified network of railways and roads have been set up in the former backward regions of the country, such as the prospering republics of Central Asia and the Caucasus, and the burgeoning regions of Siberia and the Far East.

Let us now take a closer look at the different aspects of the developed socialist economy, beginning with an analysis of the growth of production during the years of Soviet

power. Although capitalism developed fairly rapidly during the decades preceding the October 1917 Revolution, pre-revolutionary Russia lagged considerably behind the developed countries of Europe and North America. This is evidenced, for example, by data such as the size of the national income, industrial output, labour productivity and freight turnover at the time.

Different methods have been used to calculate the national income of Russia before the Revolution. According to S. N. Prokopovich, the national income for the fifty *gubernias* (provinces) of European Russia (excluding Poland and Finland) in 1913 was 11,800 million gold rubles.[1] In 1927, S.G. Strumilin made calculations that were published by USSR Gosplan (State Planning Committee) in connection with the compilation of a draft five-year plan for the financial years 1926/27-1930/31[2]. According to his estimate, the 1913 national income of the area within the boundaries as they were until 1939 was 14,500 million gold rubles, and of the former Russian Empire, 17,100 million. In the same year, the national income of the USA was 32,000 million dollars, or 62,400 million gold rubles (according to the gold-based rate of exchange at the time, 1 dollar= 1 ruble 95 kopecks), i.e., roughly four times greater than that of Russia. In terms of the overall national income, Russia was also behind Great Britain (Stamp gives 2,250 million pounds sterling or 21,400 million rubles for 1913), Germany (Helfferich gives 19,800 million rubles for the same year) and France (R. Pupin gives 36,000 million francs or 13,500 million rubles for 1911).

In terms of per capita national income, Russia was even farther behind the USA. In 1913, the per capita national income for the fifty *gubernias* of European Russia was 101

[1] See S. N. Prokopovich, *The National Income of West European Countries*, Moscow, 1930, p. 47. Also *An Experiment in Calculating the National Income of the Fifty Gubernias of European Russia. 1900-1913*, edited by S. N. Prokopovich, Moscow, 1918, pp. 67-70 (in Russian).

[2] See *Prospects for Development of the National Economy of the USSR for 1926/27-1930/31*; *Perspective Orientation for 1927/28-1931/32*, Moscow, 1928 (in Russian). Also article by S. G. Strumilin in the journal *Planovoye Khozyaistvo*, 1927, No. 11; S. N. Prokopovich, *The National Income of West European Countries* (in Russian).

rubles a year, for the old (1939) boundaries of the USSR 104 rubles and for the Russian Empire as a whole 102 rubles. The US figure was 5.3 times as high.

Pre-revolutionary Russia was also well behind the developed capitalist countries in other terms. In industrial output, for example, the USA, Britain, Germany and France were ahead of Russia. The overall gross output of factories and mines in Russia in 1913 (within the 1939 USSR boundaries) amounted to 5,621 million pre-1941 rubles,[1] against 24,700 million dollars or 48,000 million rubles in the USA.

Data on rail freight turnover also reflect this production lag. In 1913, 158 million tons of freight were transported in Russia, against 969 million tons in the USA, 370 million tons in Britain and 467 million tons in Germany.

During the years of Soviet power, the economic situation in the Soviet Union has changed radically. The national income has been growing at a significantly faster rate than in the most developed capitalist countries, and in 1973 reached 362,800 million rubles. At the official exchange rate, this represents 59 per cent of the national income of the USA, calculated by methods adopted in the USSR (i.e., without counting incomes received in the non-productive sphere)[2]. Accounting for the existing price relation, which is more justified, the national income of the USSR stood at about 67 per cent of the American.[3] The national income in 1975 was twenty-five times greater than in 1913 (according to Strumilin in gold rubles).

The national income of the USSR now significantly exceeds that of all capitalist countries other than the USA. It exceeds the national income of Britain, France, the Federal Republic of Germany, Italy and the Netherlands taken together. The per capita national income in the USSR is

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[1] See *The National Economy of the USSR in Figures*, Moscow, 1924, pp. 134-35 (in Russian). In 1926/27 prices, the gross output of large-scale industry was 11,000 million rubles in 1913.

[2] See *The National Economy in the USSR in 1975*, Moscow, 1976, p. 123 (in Russian).

[3] The prices of producer goods in the USSR, expressed in dollars, are significantly lower than in the USA, while the prices of consumer goods are higher. Calculating according to the average correlation of prices, in 1972, the ruble expressed in dollars was worth 12% more than the official exchange rate implied.

still behind certain capitalist countries[1], but the national income grows faster in the USSR than in these countries.

The volume of industrial output in the USSR has increased manyfold. The gap between the USSR and the USA in terms of labour productivity in industry has been reduced considerably. The volume of agricultural output in the country has risen. The USSR now produces 85 per cent of the US agricultural output and, therefore, holds second place in the world after the USA.

In their attempts to belittle the advantages of socialism in attaining high rates of economic growth bourgeois economists sometimes refer to the fact that, in pre-revolutionary Russia, growth rates were also high. In the twelve years from 1901 to 1913, for example, pig iron smelting in Russia increased by 62 per cent, of steel by 84 per cent, and rail freight turnover almost doubled. From 1900 to 1913, the per capita national income in Russia rose by 23.5 per cent, while in the USA, by 15.4 per cent. The reason for these figures lies not in high rates of economic growth in Russia, but in the extremely low level of the national income in comparison with that of the USA and a significant increase in the US population owing to immigration.

Comparing the rate of economic growth in pre-revolutionary Russia with those at all the stages of socialist construction, the advantages of socialism become evident. In the twelve years from 1928 to 1940, industrial output actually increased by nearly 500 per cent and rail freight turnover by 350 per cent. From 1955 to 1970, when the country had already achieved a high level of development, output increased by 270 per cent and freight turnover by almost 200 per cent. During the First Five-Year-Plan period (1928-1932), the average annual increase in industrial output was about 19 per cent; in the Fifth Five-Year-Plan period (1951-1955) it was 13 per cent; in the Sixth (1956-1960) it was 10.4 per cent; in the Seventh (1961-1965), 8.6 per cent, and in the Eighth (1966-1970) it was 8.5 per cent. In the Ninth Five-Year-Plan period, the average annual increase in industrial output was 8 per cent. The rates of growth for industrial output are considerably higher than in the majority

[1] See *The National Economy of the USSR in 1975*, p. 123.

of developed capitalist countries. From 1965 to 1974, for example, industrial output in the USSR increased by 100 per cent, while in the USA by 40 per cent. It should also be remembered that, with a rapid increase in the volume of production, each additional one per cent acquires an ever increasing absolute weight.

During the years of Soviet power, the level of production in the country has increased manyfold. During this period, industrial production has been growing throughout the world, but at a much slower rate than in the USSR. This has resulted in an increase in the share of the USSR in world industrial output.

Summary data on the increase in the value of the gross output of socialist industry for the whole period during which it has existed can be supported by data on the rates of growth of individual types of output in physical terms (see Table 1).

The output of many types of industrial product rose considerably faster than industrial output as a whole. These include, above all, electricity, the production and consumption of which increased enormously, 509 times and 418 times, respectively, over the past sixty years. Extremely high growth is also characteristic of the chemical industry (sulphuric acid, plastics, chemical fibres, mineral fertilisers). The output of these products reflects technological progress in the production of objects of labour and materials. The growth in the output of the engineering industry was even greater. The output of metal-cutting tools increased nearly 129 times, of turbines by 3,183 times (in terms of capacity), of rolling plant 132 times (by weight), and of passenger cars 20,000 times, etc. All this emphasises the role of engineering in the technological retooling of all branches of the economy. The extraction of the main types of raw materials and fuel—oil, coal, iron ore, and also the production of steel, cement, etc. also grew, but to a lesser extent than the engineering output. This is understandable since technological progress ensures an increase in the final output per unit of raw material and fuel.

To a lesser degree, there was also an increase in the output of such products as cloth and footwear, the elasticity of demand for which is comparatively limited. During the

Table 1

Production of the Basic Types of Industrial Output in the USSR and the USA

Description	Unit of measurement	USSR 1913	USSR 1940	USSR 1975	USSR Growth over 1913	USA 1975
Electricity (gross)	'000 million kwh.	2.04	48.0	1,039	509 times	2,085
Oil (including condensed gas)	million tons	10.3	31.1	491	47.7 "	410
Natural gas	'000 million m³	—	3.0	270	—	560
Commercial coal	million tons	28.9	163	645	22.3 "	560
Iron ore . . .	"	9.2	29.9	233	25.3 "	851
Steel	"	4.3	18.3	141	32.7 "	110
Mineral fertilisers (assuming 100% active ingredient)	"	0.02	0.8	22.0	1,100 "	17.6
Synthetic resins and plastics	'000 tons	—	10.9	2,842	—	13,500**
Chemical fibres	"	—	11.1	955	—	3,000
Sulphuric acid	million tons	0.1	1.6	18.6	186 "	27.5
Diesel and electric locomotives	units	—	14	1,770	—	1,442*
Tractors (excluding for gardens)	'000 units	—	31.6	550	—	270*
Cement . . .	million tons	1.8	5.8	122	67.8 "	65
Cotton fabrics	'000 million m²	1.8	2.7	6.6	3.7 "	4.0
Woollen fabrics	million m²	138	155	740	5.4 "	100
Leather footwear	million pairs	68	212	698	10.3 "	400
Freight turnover for all forms of transport	'000 million ton-kilometres	126	494	5,195	41.2 "	4,350*

* 1974.
** Without resins and semi-finished products for synthetic fibres.

post-war years, the production of consumer durables (TV sets, refrigerators and the like) has started to increase rapidly.

The growth of industrial production is thus characterised above all by development of the modern industries which lead technological progress, i.e., the power industry, engineering, and the chemical industry, and this has helped modernise the structure of industry in general. The following figures reflect this change: with an overall growth of the gross industrial output from 1940 to 1975 of 17 times, electricity generation grew 21.3 times, the chemical and petro-chemical industries 44 times, engineering and metal-processing 49 times and the building-materials industry 38 times. At the same time, the fuel industry increased only 8.5 times, ferrous metallurgy 12 times, the timber, timber-processing and pulp-and-paper industries 6.3 times, light industry 5.9 times, and the food industry by 5.5 times.[1] As a result of these differences in the growth rates of various industries, the first place (in terms of the value of the gross output in producers' wholesale prices) is at the present time held by engineering and metal-processing. These industries produce about a quarter of the gross output of all industry, while the food industry produces about a fifth, light industry a sixth, followed by the fuel, chemical and petro-chemical industries with about 6-7 per cent each.[2]

One of the factors responsible for the rapid growth rate of production in the USSR is the increase in the share of accumulation in the national income. Before the Revolution, accumulation accounted for only 8-10 per cent of the national income, while, according to M. V. Kolganov, the share of unearned income in the national income was 47 per cent (A. L. Veinstein ventured that this proportion was even higher).[3] The greater part of this went on non-productive consumption and this explains the small share of accumulation. After the Revolution, these proportions began to change rapidly.

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[1] See *The USSR in Figures in 1975*, p. 81.

[2] See *The National Economy of the USSR in 1975*. Statistical Yearbook, Moscow, 1976, p. 225 (in Russian).

[3] See M. V. Kolganov, *The National Income*, Moscow, 1959, p. 76; A. L. Veinstein, *The National Income of Russia and the USSR*, Moscow, 1968, pp. 71-72 (both in Russian).

In order to develop production to the maximum possible degree, new productive capacities had to be installed and this necessitated large capital investment and an increase in accumulation. In the 1925/26 financial year, the share of accumulation rose to 16 per cent, in 1927/28 to 19.5 per cent, and at the end of the First Five-Year-Plan period it reached 27 per cent, remaining almost at this level up to 1940 and throughout the post-war years. In the 1960s, the share of accumulation was 26.5 to 28 per cent, in 1970 it grew to 29.4 per cent and in 1975 it was 26.4 per cent. Accumulation in the productive sphere and the growth of reserves in 1975 amounted to 20.3 per cent of the used national income. In 1975, in developed capitalist countries, the share of accumulation and similar outlays in the national income calculated according to methods adopted in Matxist-Leninist economic theory (i.e., without incomes in the non-productive sphere which represent the secondary distribution of incomes) was higher than in the USSR in such countries as France, the Federal Republic of Germany, Italy, Japan, Australia, Canada.

In the USSR, the increment in fixed productive assets in the used national income was 11 per cent in 1960, but by 1968 it had dropped to 8.6 per cent, partly owing to the growth of incompleted projects. In 1970, it rose to 11.2 per cent, but in 1975, it again dropped to 11 per cent. It is clear that this share is comparatively small. It must be remembered that the increase in capital investment is, to a considerable degree, limited by the volume of production of the investment industries and by the numbers of construction workers. The total volume of capital investment is enormous and for 1918 to 1973 it was, in constant prices, 1,487,000 million rubles, which exceeds the value of all the fixed assets in the national economy, both productive and non-productive, by 18 per cent. These figures show that the fixed assets in the country today have been created almost entirely during the years of Soviet power.

The correlation between capital investment and the national income, or the capital intensity of the national income, changes at different stages of economic growth. During a period of intensive creation or replacement of fixed

assets, large capital investments are required, which grow more rapidly than output, and capital intensity thus rises. During a period when fixed assets set up previously are made to operate at greater capacity, output grows faster than capital investment. Capital investment, particularly in large-scale projects, does not give immediate returns and results in a growth of output in subsequent years. It should also be remembered that capital investment in productive assets exerts a direct influence on the growth of output, while capital investment in non-productive assets influences output only indirectly, via an increase in labour productivity.

With the acceleration of scientific and technological progress, increase is required in capital investment for developing and introducing modern technology, and also for replacing obsolete equipment. This, too, might have an impact on the increase in capital intensity. On the other hand, construction rates must be speeded up in order to reduce capital intensity.

Changes in capital intensity at different stages of development are typical for all countries. In the USA, for example, the last quarter of the 19th century saw capital investment growing faster than output. After the 1900 crisis, and right up to the end of the First World War, the growth rate of capital-intensity declined, and from 1919 right up to the end of the Second World War, output was growing faster than capital investment. Capital intensity rose in the post-war years as a result of accelerated replacement and expansion of fixed capital. From the latter half of the 1950s, output again outstripped the growth of fixed capital. In recent years the growth of output in the USA has slowed down.

In the USSR, the rates of growth of capital investment and output have changed at different stages of economic development, but have always been higher than in the USA.

In 1940, capital investment was twenty times greater than in 1922, while the national income was eleven times greater, which signifies a rise in capital intensity.[1] This was the period of industrialisation and socialist moderni-

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[1] See *The National Economy of the USSR in 1972*, pp. 47, 48 (in Russian).

sation of agriculture. In 1950, in comparison with 1940, and in 1960, in comparison with 1950, capital investment grew faster than output for two reasons: (1) there was a rapid growth of investment in new assets for the power, oil, gas and chemical industries and (2) the new assets were only slowly put into operation and the rate of growth of output was less than that of capital investment. Later the correlation became more favourable, so that in 1965, in comparison with 1960, and from 1965 to 1970 the growth of the national income somewhat outstripped that of capital investment. From 1970 to 1975 the national income again grew more slowly than the investments as a consequence of poor harvests of 1972 and 1975.

Capital investment is a growth indicator and its trends differ from those of fixed productive assets resulting from capital investment. Let us compare the growth trends of

Table 2

The Growth of Capital Investment and of the National Income (Produced)

(% of the previous date = 100) [1]

	1950: 1940	1960: 1950	1965: 1960	1970: 1965	1975: 1970
Capital investment	197	328	136	144	139.8
National income	163	265	137	145	131.7
Ratio of the growth of capital investment to that of the national income	1.20	1.24	0.99	0.99	1.06

the national income and the gross output of industry with those in fixed productive assets of the national economy as a whole and in industry for three equal periods: the pre-war period (1928-1940), the post-war period (1945-1957) and the period of transition to developed socialism (1958-1970). For comparison, Table 3 presents data on the growth

[1] Calculated from *The National Economy of the USSR in 1975*, p. 48.

Table 3

Increments in Production Indicators

	1928	1940	Mean annual increment 1928-40	1945	1957	Mean annual increment 1945-57	1958	1970	Mean annual increment 1958-70	1970	1975*	Mean annual increment 1970-75
National income (produced)	100	450**	13.3	100	402**	12.3	100	230**	7.2	100	132	5.7
Fixed productive assets of the national economy	100	242***	7.7	100	282****	9.0	100	286	9.1	100	152	8.7
Industrial output (gross)	100	582***	15.8	100	422****	12.1	100	289	9.3	100	143	7.4
Fixed productive assets of industry	100	696***	17.5	100	321****	10.2	100	316	10.1	100	151	8.6
Productivity of labour in industry	100	313*****	10.0	100	216*****	6.6	100	188*****	5.4	100	134	6.0

* *The National Economy of the USSR in 1975*, pp. 53-54 (in Russian).
** *The National Economy of the USSR in 1970*, p. 544 (in Russian).
*** *The USSR in Figures in 1966*, p. 20 (in Russian).
**** *The USSR in Figures in 1962*, pp. 32 and 33 (in Russian).
***** *The National Economy of the USSR in 1970*, p. 64 (in Russian).

of these indicators for 1975 as a percentage of 1970. Up to 1940, the growth of fixed productive assets lagged behind that of the national income. During the twelve post-war years, the difference decreased somewhat because, at this time, fixed assets destroyed during the war were being intensively restored. Between 1958 and 1970, fixed productive assets grew even faster than during the previous twelve years, but the growth of the national income dropped to below that of assets. The same trend continued from 1970 to 1975.

The change in the ratio between the growth of the national income and that of fixed assets signified a change in the output-assets ratio. Up to 1955, this ratio was increasing, then it began to fall somewhat and during the Eighth Five-Year-Plan period (1966-1970) stabilised at a higher level than in 1940, but lower than in 1950. Between 1970 and 1975 it again dropped.

The rate of economic growth is governed by various factors, conditions and development tasks. These include: reserves of live and embodied labour and their release into operation, as was the case, for example, during the post-war reconstruction of the economy; a change in the structure of production and, in particular, the proportion of capital-intensive industries; a change in the quality of natural resources used; an increase in the cost of construction work, and so on.

The proportions in industry differ somewhat from those in the economy as a whole. From 1928 to 1940, the growth of industrial productive assets was somewhat ahead of that of the gross output of industry. During these years, the country was being industrialised and industrial productive assets were growing particularly rapidly. Between 1945 and 1957, the growth rate of the gross industrial output was higher than that of assets, but, between 1958 and 1970, the relationship was reversed: assets continued to grow at the previous rate, while the growth of output slowed down. The growth rate of labour productivity also dropped. From 1970 to 1975, however, it was on the increase.

During the Eighth Five-Year-Plan period, the economic indicators, their growth rates and the balance between them improved. The rates of growth of the national income and

Table 4

Indicators of the Development of the National Economy from 1961 to 1975

(% for the period)

	1961-1965	average per year	1966-1970	average per year	1971-1975	average per year
National income (used)	132	5.7	141	7.2	128	5.1
Fixed productive assets of the national economy	160	9.9	148	8.2	152	8.7
Gross output of industry	151	8.6	150	8.5	143	7.4
Fixed productive assets of industry . .	169	11.1	152	8.8	151	8.6
Productivity of labour in industry . .	121	4.6	133	5.8	134	6.0

of labour productivity in industry increased in comparison with the previous five-year period, while those of fixed productive assets in the national economy and in industry fell. In other words, the output-assets ratio rose. The growth of the gross industrial output was approximately the same as that of industrial productive assets (150 and 152 per cent, respectively, in 1970 in relation to 1966), i.e., the assets-output ratio of industrial production hardly increased.

During the Ninth Five-Year-Plan period (1971-1975), the growth rates of the national income and fixed productive assets levelled out and the productivity of labour grew even faster than during the previous five years.

2. THE REASONS BEHIND FLUCTUATIONS OF THE DEVELOPMENT RATES AND OUTPUT-ASSETS RATIO

The significant differences in the growth rate of the economy in the various periods of the building of communist society demand analysis of the factors governing them.

During the pre-war five-year plans (up to 1941), the major factors behind the rapid growth rates were the fundamental technical modernisation of the national economy, industrialisation of the country, modernisation of agriculture and acceleration of the development of transport. These years saw the transition from manual to mechanised labour in the extractive and construction industries, in agriculture and in handling operations.

It should be remembered that the mechanisation of labour in all these branches was started virtually from scratch. The transition from manual to mechanised labour has a much greater effect than that from one type of mechanisation to another, however much more advanced it may be. Mechanisation took place under the most difficult conditions, with a lack of skilled, and sometimes even capable workers, and a need for rapid training of personnel at all levels—engineers, technicians, workers, to say nothing of production administrators.

Along with mechanisation, production efficiency was to be raised by electricity, of which 8 times more was used in production processes in 1940 than in 1913. Also of considerable significance was intensification of the use of machinery in industry, which was furthered by a gradual increase in plan figures, socialist emulation, and moral and material factors stimulating an increase in the productivity of labour. New technology was being introduced. A large number of inventions and improvements were put into effect. Between 1950 and 1970 alone, their number increased more than 5 times, and from 1970 to 1975, by another 14 per cent.[1] The number of new types of machinery, equipment and apparatus developed in 1971-1975 was 20,000 or 4.6 times larger than in 1951-1975.

From 1971 to 1975, full-scale production started of 16,500 new types of industrial product, against 8,400 in the years from 1966 to 1970, and more than 1,400 obsolete types of machinery, equipment, apparatus, instruments and articles were taken out of production, against 2,500 from 1966 to 1970. This all testifies to the accelerated introduction of new technology.

[1] See *The National Economy of the USSR in 1975*, p. 171; *The USSR in Figures in 1975*, p. 72 (in Russian).

Branches of engineering that promote technological progress were created and grew significantly. These included the production of automatic transfer lines and machine-tools, instrument-making, production of equipment for the chemical industry, modern transport engineering, the production of machinery for agriculture and construction. The production of synthetic chemical materials expanded and the output of consumer durables increased substantially.

Recent decades are renowned for the considerable successes achieved in space exploration, the development of aviation, the creation of new power sources, new materials and new production techniques, and achievements in physics, chemistry, particularly organic chemistry, electronics, and computer technology. These achievements would not have been possible without the creation of new branches of industry and development of existing ones and without research into new fields, which brought about a fundamental change in the structure of production.

Technological progress is promoted by the electric power industry, the chemical industry and mechanical engineering, which during the period from 1950 to 1975 grew 40 per cent, 140 per cent and 220 per cent faster, respectively, than industry as a whole. The growth of the electric power industry made for a sharp increase in the amount of electricity used in industry, which, by 1975, had increased ten times over the 1950 level. There were also increases in the concentration of production, the capacity of plants in the power, iron-and-steel and chemical industries, i.e., those industries in which an increase in capacity raises the productivity of labour and efficiency of production. The improvement in technico-economic indicators also testifies to technological progress. Thus, the expenditure of conventional fuel per kilowatt-hour produced in electric power stations fell from 590 g in 1950 to 340 g in 1975. The utilisation coefficient of blast furnaces fell from 0.977 cubic metres per ton of pig iron in 1950 to 0.568 cubic metres in 1975. The average daily yield of steel per square metre of furnace floor in open-hearth furnaces rose from 5.30 to 9.74 tons. Mechanical power per worker in construction increased by 8.5 times from 1950 to 1975. Great technical advances were made in agriculture.

During all these years, there was a certain decrease in return on assets, which was due to a number of both objective and subjective factors. The objective factors included, above all, a change in the branch structure of production. Different branches of industry have entirely different returns on assets.

It is obvious that, if the share of industries with a high output-assets ratio rises, the average ratio for industry as a whole will also rise, and vice versa. Thus, from 1940 to 1975, the share of the electric power industry, building materials and chemical industries (with returns on assets of 25 kopecks, 1 ruble 10 kopecks and 1 ruble 10 kopecks, respectively) increased significantly, while that of the light and food industries (5 rubles, and 3 rubles 30 kopecks respectively) dropped. As a result, the average return on assets for industry fell. This fall was not offset by the increase in the share of the engineering industry (return on assets about two rubles) or the fall in that of the fuel industry (return on assets 50 kopecks) and the iron-and-steel industry (return on assets 83 kopecks). The drop in the output-assets ratio does not imply a drop in efficiency, as it might be compensated for by a lowering of production costs.

The output-assets ratio falls when outlays on raw materials are raised due to exhaustion of the best sources, to a transition to a raw material with a lower content of the useful component, that is more difficult to extract or involves greater transportation costs. For example, during the 1960s, a switch was made to ore with an average iron content of 37.3 per cent, and so, in 1970 several hundred million rubles was spent on extracting and concentrating additional quantities of ore to satisfy the demand for metal (in 1960, 55 per cent of ore had to be concentrated, while in 1970—79.3 per cent[1]). Deeper wells had to be sunk for oil, and undersea deposits were tapped; and the depth of coal mines increased. From 1970 to 1975, the production costs of the oil-extracting industry increased by 13.5 per cent, of the gas industry by 40 per cent (because of increased extraction in the North) and of the coal industry by

[1] See Y. V. Yakovets, *Prices in a Planned Economy*, Moscow, 1974, p. 132 (in Russian).

7 per cent.[1] During the four years that the new wholesale prices have been in operation, the production costs of 12 products of the mining industry have risen, of six have fallen and of one remained unchanged. This was a result of the deposits being mined at a greater depth.[2] The average distance of rail freight carriage increased sharply: for ore, from 552 kilometres in 1960 to 753 km in 1975; for timber, from 1,387 to 1,647; for mineral building materials, from 364 to 465, and for coal from 681 to 695 km.[3] All these factors caused the cost of raw materials to rise and led to a decrease in the efficiency of production.

Furthermore, the accelerated development of production in new regions, particularly in the East, must be mentioned. Whereas the output of all industry rose 15 times from 1940 to 1973, that of industry in the Eastern regions, including the Urals, increased 19 times, including the output of the regions east of the Urals which increased 18 times.[4]

The shift of production to new areas has led to a rise in the cost of production, a drop, although a temporary one, in its efficiency, to say nothing of the increase in haulage distances, meaning also a rise in transportation costs.

The decline in the output-assets ratio was also affected to some extent by the drop in the coefficient of equipment use. Shorter hours during the second and third shifts means that equipment is not being used to capacity, but at the same time, it implies an improvement in the labour conditions, as work on the first shift is always more attractive for workers than the second or third. More account will evidently be taken of socio-economic considerations in the future in deciding how many shifts are advisable. The transition from an eight-hour to a seven-hour working day was reflected in the growth rate of the annual productivity of labour, since the number of working hours per worker dropped by about 15 per cent, while the increase in the hourly productivity of labour did not fully compensate for this drop. Since a shorter working day was introduced,

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[1] See *The National Economy of the USSR in 1975*, p. 229.
[2] See Y. V. Yakovets, op. cit., p. 132.
[3] See *The National Economy of the USSR in 1975*, pp. 459-60. (ton-kilometres divided over tons).
[4] See *The National Economy of the USSR in 1973*, p. 222.

the annual productivity of labour has increased more slowly than the hourly, and this has affected the annual rate of economic growth as a whole.

The 1965 economic reform has made it possible, from the second half of the 1960s, to stabilise the output-assets ratio. In 1970, this ratio in industry was still at roughly the 1965 level. Thanks to the new system of management, the balance has changed between the extensive and the intensive factors governing development of the national economy, utilisation of resources has improved, and so on.

The role of extensive and intensive factors affecting the development of production changes at different stages. The extensive course of development, i.e., the attraction of new labour and natural resources into production, the creation of new job vacancies, and the construction and commissioning of new plant, was characteristic of the earlier stages of economic growth in the USSR. This required a significant capital investment. The intensive course of development involves fuller utilisation of existing production reserves, manpower and materials, the application of efficient new techniques and technology, improvement of management and planning. It makes it possible to increase the loading of machinery, decrease capital investment and production costs per unit of output, and raise efficiency.

In the conditions of developed socialism, when a high level of production has been achieved in the wake of rapid scientific and technological progress, fuller utilisation of intensive growth factors is required, because, with full employment, the opportunities for attracting new manpower into production are limited by population growth; the best sources of natural resources are already being exploited, and capital construction must be oriented towards installation of new technology.

At the present time the growth rate of the number of workers in industry is falling, while that of production is rising rapidly. Between 1960 and 1965, the mean annual growth in the number of workers in industry was 3.7 per cent, from 1965 to 1970 it was 2.7 per cent, and from 1971 to 1975, only 1.4 per cent. The growth rate of the number of workers engaged in material production as a whole was even lower owing to the reduction in the numbers employed

in agriculture as a result of more and more mechanical power being used. From 1965 to 1975, the numbers employed in agriculture fell by 4.4 million, or 16 per cent, i.e., by an average of 1.5 per cent a year (not counting those employed on private subsidiary plots). The numbers employed in industry increased over the same years by 6.6 million, in transport by 2 million, in construction by 3.3 million and in other branches of material production by 3.8 million.

An important indicator of intensification is improved utilisation of materials and machinery. The amount of raw and other materials processed is growing from year to year, but slightly more slowly than the output of the manufacturing industry, which means that they are utilised to a greater extent and that less material per unit of output is required. According to the USSR Central Statistical Board (CSB), between 1965 and 1975 the output of the extractive industry rose, in constant prices, by 62 per cent, while that of the manufacturing industry rose by 121 per cent. Expenditure of fuel per kilowatt-hour of enegry used fell, and the amount of iron ore per ton of smelted pig iron also dropped slightly. The decrease in the material used in production per unit of output is still not great, but changes are taking place in the direction of intensification.

The same can be said about the building of new enterprises. The number of new industrial enterprises built and put into operation during recent years has fallen. According to CSB data, for example, during the Sixth Five-Year-Plan period, 4,870 new units were built, 3,290 during the Seventh and 1,870 during the Eighth. These are only approximate figures, it is true, since the capacity and amount of equipment available in the new enterprises are not taken into account here. Some of these enterprises produce new types of output, have modern machinery and use the latest production techniques. A fairly large number of new enterprises, however, are based on tried and tested technology, and a cut in the number of such enterprises implies a cut-back in the operation of one of the extensive factors.

In future, the share of investment made to modernise and expand existing enterprises in the total volume of capital investment in industry will be raised. In 1960, this share was 55 per cent, by 1966 had reached 62 per cent, by

1970 had dropped to 58 per cent and in 1975 rose to 67 per cent. Although these figures do not always accurately reflect the real facts, as in a number of cases modernisation of enterprises virtually means reconstruction, the general trend for the share of modernisation in capital investment to rise is fairly steady and will apparently continue in conjunction with further economic growth. This also indicates a growth in the intensive factors governing the growth of production.

3. THE OPERATION OF INTENSIVE FACTORS AND THE TASKS INVOLVED IN IMPROVING ECONOMIC BALANCES

The intensive factors promoting economic growth do not operate in isolation, and may have various causes, and so they deserve more detailed study.

The productivity of labour is defined as the ratio of the gross output to the number of workers. If this ratio increases, then labour productivity is rising. In this way, everything that affects the growth of production, for a given number of workers, is included in Soviet statistics as a factor governing the growth of labour productivity. These factors include the growth of the assets-worker ratio, the application of up-to-date machinery, increase in skills, improvement in the organisation of production, and material and moral incentives.

It turns out that an increase in output is achieved either through raising labour productivity (whether dependent on the worker or not) or through increasing the number of workers. With labour productivity accounting for 85 per cent of the increase in output, only 15 per cent remains for the number of workers to rise in a five-year period.

The majority of the factors promoting an increase in labour productivity mentioned above (new machinery, increasing skills, and so on) result in additional running costs and capital investment. These expenditures are rational only if the effect of rising labour productivity exceeds expenditure, and if labour productivity grows faster than the assets available per worker. This means that assets must grow as a result of improved instruments of labour being used to

ensure that output grows faster than the assets. In this case, there will be an assets-saving type of intensive development. If, however, the expenditure results in output growing at the same rate as assets or slower, this is capital-consuming development. In this case, output grows in the same proportion as (or slower than) capital investment, requiring increasing expenditure of social labour on creating new assets. If the number of workers has not changed, with labour productivity rising—although not faster than the assets thus available per worker—the result will either correspond to or be less than outlays. Such a balance between results and expenditures hardly indicates a rise in the efficiency of production. If, however, assets grow faster than output, while running costs fall, and if the increase in assets is covered by savings in running costs within the given period, this increase in the assets-output ratio is efficient.

This principle also applies to decreases in the amount of material per unit of output in production. The expediency of introducing innovations depends on the balance between necessary outlays and their effect. Reducing the amount of material per unit of output becomes a factor intensifying production when the expenditure involved is covered by the effect received within the given period.

The basis for raising labour productivity and reducing material expenditure and capital outlays per unit of output is technological progress, the most important factor in the intensification of production. Another vital factor is the ratio of expenditures on creating and introducing new technology and the results of this operation. The development and introduction of new technology requires capital investment, and only techniques with at least an average efficiency for the given product can raise the efficiency of production. Efficiency is revealed through cuts in running production costs, in other words, labour productivity, and the material and capital intensity of production.

There are considerable internal reserves within the economy of the USSR for raising the efficiency of social production. Rational use of live and embodied labour can ensure a considerable acceleration of economic growth and a rise in the population's material and cultural standards. All

these reserves must be revealed and the right way of utilising them must be determined so that they can be put to use, starting with the most efficient.

At the same time, more balanced proportions in economic development must be achieved. Certain sectors of the economy must forge ahead, while others must not be allowed to lag too far behind, as this might lead to an imbalance and ultimately slow down the development of the economy.

This applies, above all, to agriculture. The mean annual gross agricultural output in 1971-1975 was only 130 per cent of the 1940 level, while the total population of the USSR had grown by 32 per cent and urban population by 150 per cent over the same period. Grain yields doubled during these years; the cattle population rose by 100 per cent and that of cows by 54 per cent. A considerable part of this increase has taken place during the last ten years and is a result of the measures taken by the Party to improve agriculture. During the Tenth Five-Year-Plan period (1976-1980), agriculture is faced with the task of ensuring further growth and greater stability of agricultural production, and increasing the efficiency of crop and cattle farming in all possible ways. During the current five-year-plan period, the mean annual volume of agricultural output will increase by 16 per cent over the last five years. The mean annual labour productivity on collective and state farms is to rise by 28 per cent. In this connection, measures have been outlined to ensure a steady intensification of agricultural production and strengthen its material and technical base. The share of agriculture in capital investment is increasing and comprehensive development of agriculture is envisaged with the branches of industry that provide it with means of production and process its produce. The standard of living of the rural population will also rise.

The growth rate in the engineering industry must be speeded up. Even though it has exceeded that of other branches of industry for several years, it still does not satisfy the country's demand. The replacement of obsolete equipment in industry, particularly in the light and food industries, must be accelerated, as it must in other branches too, including engineering itself, and the average operational life

of equipment must be cut. All this will help reduce the cost of output, raise labour productivity, and speed up the development of other branches of industry and of the entire national economy.

One major task is to eliminate the shortcomings in capital construction, including underfulfilment of plans for putting projects under construction into operation, the lengthening of construction periods and exceeding of cost estimates. All these shortcomings have a detrimental effect on the utilisation of the large sums allocated for capital construction and reduce its efficiency.

Another major economic task is to speed up the development of transport. The railway network has almost doubled during Soviet times, while the freight turnover has increased more than fortyfold and, as a result, the railway network carries a much greater traffic than in any other developed country. During the last ten years, road transport has developed significantly. The length of highways has almost doubled, while that of surfaced roads has increased by 162 per cent. This is far from sufficient, however.

Of considerable significance for development of the entire national economy is the growth of the services (retail trade, public catering, clothing, footwear and housing repairs, hotels and so on). Less than a quarter of those employed in the national economy of the USSR work in non-productive branches, including administration. During the Ninth Five-Year-Plan period, the service industry grew considerably, the volume of domestic services and public catering increased and the retail network improved. The proportion of employees in the non-productive spheres rose. The development of this industry is of major importance both for satisfying the needs of the people and for raising the productivity of social labour.

Further economic growth in the country is promoted by improvement of the system of planning and economic incentives. The basis for the improvement in planning is the comprehensive nature of plans, the systems approach and elaboration of several versions of the plan so that the optimal one might be selected. All the measures envisaged in the plan must be economically justified so that the decisions taken are the best possible. The compilation of a long-

term plan for development of the economy, that has started in the USSR, requires considerable preparatory work and forecasting of the economy's development.

Wider use must be made of electronic computers, and so they must be produced in greater numbers. One major condition for the application of economico-mathematical methods and computers is improvement of the information system that should be based on common principles.

Measures to improve planning must be closely co-ordinated with regularisation of material incentives, particularly for putting efficient new technology into operation and improving the quality of output. Increase in the productivity of labour depends to a considerable degree on proper application of material incentives and rational use of the forms of wages and bonuses most suited to the given type of production. With the further development of socialist production relations, moral incentives, the cultivation of a communist attitude to labour and concern for improving production are gaining increasingly in significance.

CHAPTER II

MANAGEMENT, PLANNING AND FORECASTING

1. IMPROVING ECONOMIC PLANNING

The socialist economy is characterised by rapid growth and progressive changes in structure, and this underlines the significance of analysing its movements. A study of the socialist economy must not be confined to the present day, since the economy is trained on the future, in the direction of its further development. The growth in the scale of production and the qualitative changes in the economy make new demands on management and necessitate improvement of its forms and methods.

Management of the socialist economy can be defined as a co-ordinated system of long-term, short-term and current practical measures to achieve the maximum economic effect, given the available resources and the most economical expenditure of social labour possible.

It is the management mechanism—national economic planning, self-sufficiency and effective organisational forms—that ensure that management of the socialist economy complies with all that is required of it, i.e., the need for centralised direction of the vast economy and of each of its units, overall co-ordination of the interests of all these units and of the economy as a whole, and precise measures taken on time.

National economic planning is one of the major victories of the social science and practice of the building of socialism and ranks among the greatest of human achievements. First applied by Lenin, planning is almost sixty years old. It originated from Lenin's formulation of the basic economic law of socialism, that of the planned, and bal-

anced development of the national economy. He established the direction of planning following which the USSR national economy puts into practice the advantages of the socialist system.

The Soviet economy develops according to plans, making all-round use of resources according to requirements, redistributing and investing them so as to ensure rapid progress. The great advantage of centralised planning is particularly obvious in tackling the major tasks involved in economic growth. Some of them already solved or currently being tackled, these tasks include industrialisation within a short period on the basis of internal resources, the advancement of formerly backward outlying areas of the country, the transition from mainly extensive to mainly intensive development, technological progress in all branches of the economy, the creation of large-scale mechanised socialist agriculture, and so on. When the economy is faced with new major tasks for its development, requiring thoroughgoing changes in the general economic balance, it is planning that makes possible a rapid redistribution of manpower and material resources as required.

On the other hand, in the periods between such turning-points, when economic development follows a more or less straight course and the balances are changing gradually, the planning bodies face simpler tasks, primarily those of maintaining the balance and managing the economy directly.

The problems and tasks involved in improving planning are nowadays attracting the attention of both theorists and pragmatists. Why must national economic planning be improved?

Above all, the enormous size of the economic organism resulting from the high growth rates over many years has made economic management extremely complicated. The centralised planning agencies must, therefore, be relieved of many current, practical tasks and concentrate on the most important planning tasks, at the same tim improving the quality of planning. Furthermore, increased demands are made on planning by accelerated scientific and technological progress and the increasing complexity of economic links between branches and regions. The response to and

introduction of achievements in the development of science and technology into production must be increasingly rapid, and specialisation and co-operation must be ensured. It is of growing importance that planning reflect requirements—consumption and production, personal and social, material and cultural. Planning must be based more and more not only on resources, but also on requirements and a combination of both. It must ensure rising efficiency of social production, which is an increasingly major factor governing the acceleration of growth rates. Finally, planning covers external economic links, in the first place those with socialist countries, integration processes, the building of joint enterprises, co-operation and trade. All these characteristic tasks of developed socialism necessitate improvement of the economic management mechanism.

National economic planning is a higher form of economic management than all previous ones. It envisages the application of commodity-money relations which, under socialism, are made to help improve the operation of the planning mechanism for running the economy. Some Soviet economists exaggerate the role of commodity-money relations in the socialist economy. They argue that, given a "correct" system of prices and plan targets assigned to enterprises, commodity-money relations would play a regulating role and help the economy to "regulate itself". The conclusion is drawn, therefore, that the commodity-money mechanism is efficient enough and that the Soviet Union should, therefore, draw on the experience of its application in the capitalist economy.[1]

There can, however, be no alternative in the capitalist system to the objectively existing market mechanism for managing the economy. Capitalists develop production by the trial and error method, groping in the dark, taking risks, testing in practice whether the measure considered will pass, i.e., whether it will bring profit or loss. This method

[1] The view held by some Western economists that national economic planning is extraordinarily complex results from a lack of information and a misunderstanding of planning as a continuous process, taking account of both current tasks and the fulfilment of previous plans, and applied consistently at all levels of economic management (see, for example, E. Mansfield, *Economics*, 1974, pp. 703-04).

leads inevitably to waste of manpower and material resources, to competition, bankruptcy and unemployment. Often, a considerable length of time is required before the feedback is set up, until which time money has to be invested, further increasing the risk. It must be stressed that the market mechanism under capitalism only operated in a more or less pure form during the period of free competition. Later, under the domination of monopolies, this mechanism was modified. The monopolies are able to take far less account of the market and of the consumer than was previously necessary and can hold down prices for a long time in order to drive out competitors and then raise prices and reap super-profits. Here there can be no question of any self-regulation or automatic regulation. The management mechanism used brings the maximum benefit to the monopolies.

The situation has become more complex in the last few decades of growing inflation and instability of monetary markets, deficits in the balance of payments and trade, high taxes and budget deficits, high unemployment. What question can there be of borrowing market methods?

On the contrary, it is the capitalist states that are attempting to borrow planning methods from the socialist system. Owing to the domination of private ownership of the means of production, however, some of the elements of production planning can only be applied within the framework of corporations and enterprises, and even then only in so far as these "plans" are not swept away by spontaneous phenomena. As far as the entire national economy is concerned, there can be no planning based on directives, as this would conflict with the very basis of the capitalist system, the interests of competing groups and of individual capitalists. In capitalist society, so-called indicative planning is used. This consists in the elaboration of proposals for the way the economy should develop, establishing economic indicators that might serve as a reference point for the enterprise, without being obligatory, of course. The experience in Japan, France and several other countries shows that these indicators do not stand up at all in practice and prove extremely remote from the actual results achieved.

In the socialist economy alone national economic planning is the main feature of the economic management mech-

anism, determined by the socialist mode of production.

On the other hand, the role of value categories, commodity-money relations and self-sufficiency must not be underestimated. Under socialism, products take the form of commodities, and the planned distribution of output between socialist enterprises is on a purchase-and-sale basis. Consumer goods are sold to the population through the trade network. Economic self-sufficiency presupposes the independence and initiative of the enterprise or association in fulfilling and overfulfilling the plan, the use of prices, profits, credit, wages and material incentives to this end, i.e., the value categories inherent in commodity-money relations. Commodity-money relations and self-sufficiency under socialism develop within the framework of the general planning management mechanism.

The law of value belongs among the objective economic laws operating under socialism and used in management. The country is not yet in a position to make an efficient and smooth transition to direct measurement of labour inputs for the purposes of planning and economic management. It is, in principle, possible, particularly with the aid of computers, but would necessitate too complex calculations. This is why planners have to use the simpler and cheaper, though less accurate, method of value. Value categories serve as a reasonably reliable way of measuring labour inputs, and consequently of determining the efficiency of production, selecting the best ways for its development, and ways of managing production and sales of output. Commodity-money relations are used to improve the planning system. It is a matter of using value categories not only to help fulfil the plan for the sales of output, increase in profits, growth of accumulation and its rational distribution, but also to improve the quality of planning itself, select the economically most efficient versions of the plans for expenditure, production costs and capital investment, and to elaborate not only material and labour balances, but also value balances for this purpose.

The law of value helps the law of the planned and balanced development of the national economy to operate more efficiently.

For a self-supporting economy, an important role among value indicators is played by profits, which reflect economic efficiency and serve as a material incentive to the enterprise as a whole and to its workers. The profit of an individual enterprise also has a nation-wide significance, as it is an increasingly important element in accumulation in the national economy. All this means that profit, too, can be used as a management lever. The transition to full self-sufficiency, and the increasing role of the initiative and independence of enterprises combine within the management system to ensure that the economy develops in accordance with the goals of socialism.

The system of value categories, commodity-money relations and self-sufficiency must be consolidated and expanded. For all the advantages of centralised planning, it is impossible for a centralised agency to decide all issues concerning the management of the economy and of enterprises. This inevitably leads to formalism and might engender bureaucracy. Experience has shown the need to combine centralised planning with development of the independence and initiative of the enterprise. However, while allowing the enterprise a certain freedom of action within the framework of the plan, there must, at the same time, be control over its activities. It is extremely important that the responsibility of managers and executives before society be increased, that those who are not up to the tasks before them be replaced and that new people be systematically trained and promoted.

The current system of self-sufficiency of the enterprise needs to be developed and improved. Indicators of the performance of an enterprise are needed, for example, to act as an incentive for it to adopt larger production programmes, in which case fuller use would be made of its capacity. This can be achieved by establishing that the quotas on the basis of which incentive funds are calculated do not change for several years, e.g., for the duration of the five-year plan. In order that the interests of the enterprise might be better combined with those of society, apart from the volume of output sold, the fulfilment of contracts for the delivery of output of appropriate quality to the consumer within the appointed time is now also being taken into account.

Frequent revisions of plans by higher organisations must be abandoned, as must planning "from the level attained", with no account being taken of the actual production potential of the enterprise. In the sphere of prices, considerable flexibility of price-formation should be ensured and the time taken to determine and approve new prices cut. One possible way is to hand over certain powers in the sphere of price-formation on individual types of product to production associations, ensuring, of course, that they adhere strictly to the price policy and on the condition that subsequent control over prices be increased. Of fundamental significance, particularly in stimulating the production of new machinery and limiting the output of obsolete models, is improvement of price-formation for new output by establishing stepped prices, and also increased deductions from profits into the state revenue for the production of obsolete articles.

Fuller use should be made of credit, particularly for production needs, acceleration of economic turnover and the long-term needs of capital construction. In our opinion, insufficient use is being made of long-term credit. It would be more expedient to extend it considerably, while cutting back on direct budgetary financing of capital investment. This would help to put capital construction in order, cut out many unjustified requests for capital investment and reduce the fragmentation of funds. At the same time, the interest on the credit must be fairly high (within the bounds of the efficiency quotas of capital investment), and the request for long-term credit should be made by the association responsible for the efficiency of the project under construction. Meanwhile, short-term credit can be used as an additional resource for expanding production, provided its cost is covered by the ensuing increase in the surplus product.

Finally, the organisational forms corresponding to the demands of each stage of development constitute a major factor in the management of the socialist economy. The existing forms of management in all branches of the economy—in industry, construction, agriculture, transport and trade—took shape over several years. They are based on the Leninist principle of democratic centralism. These forms

must combine branch integration (State Planning Committee—branch—association—enterprise) with the territorial system (State Planning Committee—republic—region—enterprise). All measures to develop a branch of the economy must be taken on a territorial basis. But this is not enough: within the city, region, district and republic, each measure must be taken to achieve a general goal—the development of the economy of the given territorial unit.

To ensure comprehensive co-ordination and concerted operation, branch and territorial management and planning are constantly being improved and changed.

Experience has shown that management of almost 50,000 industrial enterprises, operating on a fully non-subsidised basis and keeping independent balance-sheets, by ministries and chief committees financed from the state budget, often leads to an undesirable replacement of economic by administrative management methods and deprives the entire management system of the necessary flexibility. For example, in order to ensure that enterprises made deliveries to each other on time, on enormous number of contracts had to be concluded, the fulfilment of which was extremely difficult to ensure.

At the present time, in accordance with decisions taken, a transition is taking place to management through a system of associations, each comprising a number of enterprises within the given industry. Associations offer a number of advantages, for they can maintain closer contact with their enterprises than ministries and chief committees. Operating on a self-financing basis, associations have an interest in the efficient operation of its member enterprises. Associations can make more flexible use of incentive funds. The supplies and sales system is improved and the introduction of new technology is facilitated.

Special mention should be made of scientific production associations, with a research or design institute at the head. Favourable conditions are created within such associations for developing new technology, experimental testing, development and introduction, which promotes a considerable acceleration of technological progress.[1]

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[1] For more detail, see Chapter 10.

At the 25th Congress of the CPSU the task was set of accomplishing the creation of production associations in industry during the Tenth Five-Year-Plan period.

One major task in improving planning is the working-out of long-term plans and forecasts for the development of the national economy. The need for long-term planning (for fifteen- to twenty-year periods) and even longer-term forecasting arises from the fact that many of the processes taking place in the economy are not completed within five or even ten years.

This is particularly true of capital construction. The scope of capital construction grows each year as the national income and the accumulation fund grow, reaching an average of 100,000 million rubles a year during the last five-year-plan period. This necessitates a significant increase in the efficiency of capital construction, closer co-ordination of its volume with requirements and possibilities, and the establishment of a feasible priority list. Comprehensive construction programmes covering many branches of the economy and extending for years are gaining constantly in importance. Examples of such programmes are the building of the Urals-Kuznetsk Combine during the First, Second and Third Five-Years plans, or the improvement programme on the Volga, which helped solve numerous problems of power generation, transport, irrigation, fisheries, the development of the oil- and gas-fields in Western Siberia, the commissioning of the Sayany complex, the exploitation of the Kursk Magnetic Anomaly, and so on.

Long-term planning is also called for by the development level reached by science and technology. The acceleration of scientific and technological progress helps cut the period between a scientific problem being solved and its practical realisation, but even these shorter periods are usually double or treble the five-year-plan period. Scientific research itself often requires more than five years to yield tangible results. It has been estimated, for example, that a long time will pass before thermo-nuclear synthesis can be used for industrial production of energy, or mankind is rid of malignant tumours, and so on. Changes in demographic processes also take a long period of time, several generations.

A long-term plan is necessary for improving the quality of five-year plans. Essentially, a five-year plan for the development of a given industry can only be drawn up if there is data available on the development of related industries for a period of at least ten years, even though, at first glance, this may seem somewhat of a paradox. In order to plan the development of the iron-and-steel industry for a period of five years, for example, the prospects for the development of steel consumers for the next five-year period must be known, since new iron-and-steel plants come into full operation only when the first five-year period is over.

Long-term planning must be continuous. This means that, as each five-year plan is being fulfilled, the plans for the next two five-year periods must be adjusted and a plan for the third period drawn up.

Improving planning means developing the methods used. National economic plans must be comprehensive, taking account of all aspects of the national economy, all its branches and regions, and internal and external links. This means that, at the same time, proportionality and equilibrium must be maintained, to ensure harmonic development of the economy, without overproduction (apart from necessary reserves) or shortages.

In order to ensure that the plan embraces as many fields as possible, without unnecessary details, the point of departure must be the key sectors that determine the development of the national economy for the planned period. These are different at different stages of development. For the GOELRO Plan in 1920, electrification of the national economy was the key sector; during the First Five-Year-Plan period (1928-32), it was industrialisation and the creation of key branches of industry; during the Ninth Five-Year-Plan period (1971-75), it was a significant increase in the material and cultural level of the population on the basis of technological progress and an increase in the efficiency of production.

An important place in planning belongs to the systems approach. Taking the key sector as a point of departure in the plan and its goal, the systems approach allows branch, functional and territorial divisions, and even subdivisions of the plans and other smaller divisions to be estab-

lished. The full network of relations between these subdivisions and their vertical and horizontal links are elaborated, and on this basis, targets are set for each subdivision and resources are allocated—manpower, materials, etc. All the relations are co-ordinated over time. The operation of the system as a whole, the achievement of targets, deliveries from one subdivision to another during the fixed time are all under control. The systems approach has been the basis of planning since the first, GOELRO Plan. No plan can be worked out unless it is based on the systems approach.

Planning also makes use of the input-output method, based on a study of resources and requirements and a comparison of them. At earlier stages of development of socialist production, the plan had to be compiled largely on the basis of resources available, on the possible development of production, and then proceeded to requirements, which could only be partially satisfied. At higher levels of production, under developed socialism, increasingly more items cease to be in short supply and it becomes possible to orientate the plan increasingly on requirements, on the basis of which the necessary development of production, i. e., growth of resources, is determined.

Intersectoral input-output tables are used in compiling the plan and ensuring that it is well balanced. When using input-output table data, it must be remembered that the indices of current and capital expenditure derived from them change over time. These possible changes must be foreseen in the calculations in order to exclude rough and often unjustified approximations. It is only possible to predict changes in these indices, however, if technological progress is properly planned.

The USSR Central Statistical Board compiles the intersectoral input-output tables on the basis of statistical data on the production ties between branches (by output) in physical and value terms, and also on fixed assets and labour expenditure. Such tables were drawn up in 1959, 1966 and 1972. It would, of course, be desirable to have these tables more frequently, even though with less detail. Intersectoral tables must be considered as a component part of the input-output tables for the national economy as a whole.

Plan input-output tables for the national economy are elaborated more frequently, virtually every time a plan is drawn up, as they constitute a component part of the latter. Plan tables for the national economy bring together physical, value and labour input-output tables and outline the basic proportions and indices of reproduction. These include determination of the size of the gross social product and national income, distribution of manpower, capital investment and fixed assets, the ratio between the two major divisions of social production (producer and consumer goods—*Tr.*), between sectors of the national economy and between branches of industry, a table of the population's incomes and commodity stocks availability, etc. In conjunction with plan input-output tables, it is essential to draw up report tables in order to reveal the proportions that have actually taken shape and reproduction indices.

The compilation of the national economic plan using the input-output method is done in stages, with plan targets being amended by means of successive approximations. This approach was used fairly widely in compiling even the first economic plans, and later came to be used by econometricians under the title of the "iterative method".

One of the goals of planning improvement is high-quality plans, that should reflect accurately both the possibilities and requirements. In that case plans are stable enough and changes are reduced to a minimum during plan fulfilment. This is of particular importance for capital construction plans, as the fewer the amendments and additions to the plan, the closer the actual construction time and its cost will correspond to the plan and the set quota. Improving the quality of plans is also of significance for production plans, for the introduction of new technology, and so on.

The main plan in the USSR is the five-year plan, which covers a sufficiently long period for many (though far from all) major measures to be implemented. It contains concrete figures for the growth of production, capital construction, technological progress, the increase in the standard of living, the development of science and culture, and distribution of productive forces. When compiling this

plan there is opportunity to make full use of the most progressive methods of planning, to make sure it is exact and efficient.

Ten five-year plans have already been drawn up in the Soviet Union and considerable experience has been accumulated on planning, and methods to improve it. The Ninth Five-Year Plan was the first plan which was broken down by years when it was assigned to ministries, associations and enterprises. Blueprints for scientific and technological progress became part of the plans. Improvement in planning is furthered by the establishment of closer co-ordination of production and consumption, study of the demand for the output of both divisions of social production, organisation of long-term direct links between producer and consumer according to plan, and the conclusion of long-term economic contracts between them.

Annual plans play a mainly practical role in implementing the targets of the five-year plan, and should not diverge noticeably from the yearly break-down of the latter. At the same time, annual plans must also be comprehensive, balanced and proportional, making full use of production potential and in this way satisfying requirements as fully as possible under the given conditions. The input-output method is also the main method used in the annual plans.

The target-oriented approach, which supplements branch planning to a considerable extent, is of great importance in improving planning. It is often difficult to ensure the comprehensive nature of branch planning. Each branch, such as the fuel, iron-and-steel, engineering, chemical and other industries, has plans of its own, which do not take enough account of the interests of other branches, and, by implication, those of the entire national economy. The target-oriented approach makes it possible to set major general economic targets to be attained by a number of branches. These targets include, for example, the development of nuclear power industry, which requires the joint efforts of the mining, metallurgical and engineering industries, as well as those of the nuclear power industry; increasing the harvest, which depends not only on improving agricultural work, but also on the development of agricultural engineering, the chemical industry, transport and

so on; satisfaction of the demand for cars, which is possible not only by increasing the output of cars, but also by building roads, motels, garages, repair shops and the like. Thus the target-oriented planning method means clearly formulated targets for the development and elaboration of programmes co-ordinated for a number of measures, covering different sectors of the economy and requiring unified, common management.

Balance links in the national economy are extremely ramified, meaning that proportionality can be ensured for extremely different combinations of branches, different degrees of resource use and differing volumes of plans. This dictates the need for detailed calculations to select the optimal version, which demands a considerable expenditure of both labour and time.

The input-output method can be used far more efficiently and with less expenditure of labour if mathematical-economic models and computers are used. With their help, tasks can be set in the selection of the optimal version which were virtually impossible using former calculating methods. Sufficient information that can now be obtained makes it possible to find the optimal versions in each sector (economic unit), or branch or region. It may be possible in the future to compile plans automatically by electronic computers for the whole economy too, but this requires extremely thorough preparation.

In order to attain the set targets, work is going on to improve the unification of the information system, adapt it to plan calculations at all levels, including the enterprise, association, branch, republic and national economy as a whole. Furthermore, calculations must be mathematically substantiated and programmes developed for all levels and sectors: industry, agriculture, transport, and so on. Computer centres are being set up in enterprises, branches, regions and republics: these are closely interconnected and also transmit information to higher bodies. This ramified automatic system for plan calculations (ASPC) necessitates the training of large numbers of personnel: programmers, operators, engineers and technicians to operate the computers, process and transmit information and run computer centres. For the creation of this entire system,

there must be a significant increase in the output of computers and communication facilities. Expenditure on setting up the automatic control and planning systems, when used in the appropriate manner, have a significant economic effect and decrease the expenditure of social labour by 10 per cent or more throughout the economy. Capital investments, according to current calculation methods, are expected to be recouped within three years.

2. PLANNING AND FORECASTING

The planning methods considered are to be developed and improved particularly in connection with the tasks involved in long-term planning. The question arises of the extent to which these methods can be applied in forecasting and where the difference lies between forecasting and planning.

When the First Five-Year Plan was elaborated in the 1920s, attention was concentrated on the difference between a plan and a forecast: the national economic plan is a directive, a mandatory law, while a forecast is only a supposition, a prediction of the specific course of development. A forecast must not, of course, be substituted for the plan. Does this mean, however, that planning can get by without science-based forecasting?

Sometimes a forecast is contrasted to the plan and it is denied that forecasting is necessary in planning. Some economists believe that forecasting is inherent only in the spontaneous pre-socialist economy. Others allow the possibility of forecasting under socialism too, but suggest that forecasts should only be made of those phenomena that cannot be planned, such as the weather and its effect on the harvest or the presence of mineral deposits. They consider that socio-economic phenomena should be planned, not forecast. In our opinion, forecasting should not be contrasted to planning, but should be seen as a stage in the planning process before the plan is drawn up.

Forecasting as a pre-plan stage should reveal the steady trends in the development of the national economy that reflect the operation of economic laws, should compare alternative, possible trends, rates and levels of development,

establish expected expenditures and results if a certain direction or rate is selected, and, finally, recommend the optimal version.

Scientific forecasting should, for example, provide for several variants to be compiled to ensure that the country be supplied with the necessary amounts of fuel and energy, so that these might be compared and the optimal combination found. With forecasting, different trends of technological progress and possible discoveries in science and their implementation are compared and the possible results are studied considering whether these discoveries are made a few years earlier or later.

Forecasts must be made of individual sectors of the economy in order that they might be brought together in aggregate national economic forecasts determining the growth of the whole economy, the trends, rate and levels of this development, and at the same time the conditions necessary for achieving the set goals. This makes it possible to introduce amendments into the development forecasts for individual aspects of the economy too. All these forecasts are interconnected, as are the aspects of the economy they represent, and amendments frequently have to be made in them in order to attain the general optimum development of the economy as a whole.

The final stage in making a forecast is to propose optimal solutions. In adopting the recommended solution, the state proceeds from the established criterion of optimality, that is, what most fully corresponds to the goals of the rapid building of communist society. A more concrete criterion for optimality in selecting economic solutions is attainment, in the interests of society, of the maximum possible results for the given expenditure of social labour, or the given results with minimum expenditure, i. e., in the final analysis, maximum productivity of live and embodied social labour. The adoption of decisions in accordance with this immutable law for economic construction leads to the fastest possible attainment of the general goal of development.

So a forecast is a scientific analysis and prediction of possible ways and rates of development of society; it establishes which of these are most likely to be optimal as re-

gards attainment of the set goals and assessment of real possibilities. Scientific forecasts of social development, based on a knowledge of economic laws, to a considerable extent comprise the essence of Marxist-Leninist socio-economic theory. The scientific forecasts given by Marx, Engels and Lenin, showing the inevitability of the transition from capitalism to socialism and substantiating the course of communist construction, are the corner-stones of Marxism-Leninism. In the development of contemporary socialist economy, forecasts are an important pre-plan scientific basis for planning, particularly long-term planning.

The plan is formulated taking account of forecasts and, in contrast to the latter, it includes the decisions that have been adopted: a definite level of production, its structure, and quantitative and qualitative indicators. It is no longer a question of probabilities, but of directives, no longer of variants, but of targets. As far as the future of such spheres as science and technology, which cannot be precisely determined, is concerned (particularly pioneer research), this is covered by plans for scientific research work. Production plans can only include scientific and technological results that have already been achieved and can readily be introduced.

Forecasting must therefore be seen as one of the stages in planning. In our opinion, these stages include: (a) analysis of the achieved (current) state of the national economy, revealing "bottlenecks" and untapped resources; (b) scientific comprehensive forecasting, taking account of individual forecasts; (c) determination of the main sectors, major trends and tasks in development for the next planned period; (d) compilation and approval of the national economic plan on the basis of the input-output method, successive approximations and the comprehensive approach; (e) control over plan fulfilment and introduction of the necessary adjustments.

Scientific forecasting evidently does not conflict with planning, but is rather an important stage preceding the compilation of the plan itself. Without scientific forecasting, it would be impossible to elaborate a justified plan for a long period. At the same time, however, forecasting differs fundamentally from planning. Forecasts are based

on probability and the figures they contain have a wide range "from-to", while plans are action programmes, that include obligatory targets and are addressed to specific sectors or bodies, though they are more or less detailed depending on the length of the period they cover. Annual plans are more concrete and detailed than five-year ones, while long-term (or general) plans are, compared with five-year plans, more general in nature, and closer to forecasts.

Considerable experience has been accumulated in the Soviet Union of perspective planning. The first long-term development plan for the Soviet economy was the GOELRO Electrification Plan drawn up in 1920. In subsequent years, beginning with 1928-1929, ten five-year plans have been drawn up, nine of which have been successfully fulfilled, while the tenth is now being implemented.

Along with national economic plans, long-term plans and forecasts are made for individual sectors of the economy and important problems of its development. At the end of the 1920s, for example, the future of the iron-and-steel industry as a whole was studied and discussed, and technico-economic variants for its development were examined, i. e., in the South or East of the country. The Communist Party then took what proved to be an extremely far-sighted decision to set up a second coal and metallurgical base in the East. Accordingly, the Magnitogorsk and Kuznetsk and then the Nizhny Tagil metallurgical plants were built. Experience confirmed the high economic efficiency of these plants, and during the Second World War, the significance of the Party's decision for the country's defence became evident. After the war, the metallurgical plants in the South were restored and fundamentally modernised.

At the beginning of the 1930s, a General Plan for Electrification of the USSR (up to 1942) was prepared. The proposals and calculations included in this document were used in perspective planning. In 1931, the Plenary Meeting of the Party's Central Committee worked out measures for the modernisation and electrification of the railways. The recommendations of this Plenary Meeting were included in the national economic plan for subsequent years. Not long before the Second World War spread to the USSR, work began on blueprints for a long-term plan for the development

of the national economy. Many of the measures planned at the time were later implemented. At the end of the 1950s and beginning of the 1960s, forecasts were made for a number of sectors of the economy for twenty years ahead.

Scientific methods of economic forecasting differ according to the subject of the forecast. Some aspects of society and its production basis reveal fairly stable development trends. These include above all a steady growth of production and consumption and the creation of the material and technical base for communism. Other fairly steady trends are demographic and natural-geographical processes; trends in fixed assets and the efficiency of their utilisation (at least on a macro-level) during the five-year period. In these circumstances, the method used is scientific extrapolation, which is based on an analysis of the path covered, with adjustments to allow for expected changes in conditions. For this, reliable and comparable comprehensive data are needed for fairly long periods on such factors as the growth of population and labour resources, trends in output, labour productivity, production costs, capital investment and fixed assets, etc.

It must be stressed that analysis of stable development trends and inert processes should certainly not mean a simple extension of the past into the future. In past years, there have been unjustified plans and decisions taken on the development of the economy, particularly in capital construction. This must not be repeated. Forecasting that takes account only of the level already attained might lead to reproduction of the economic structure of the previous period, with all its shortcomings, and at the same time to underestimation or curbing of the demands of scientific and technological progress and social development. Forecasting must take account of stable and inert processes, but must be based on changes in the conditions and factors of growth and on new progressive developments that hold out the best promise in the future. This is a condition for the scientific approach to forecasting on a macro-level. On a micro-level, apart from reflecting inert processes, forecasting must take account of concrete technical and economic conditions and projects.

For forecasts of the growth of material welfare and the cultural level of the Soviet people, assessment and elaboration of possible versions are essential depending on the determining conditions adopted. Conditions that exert an enormous influence on production and consumption and the life of society as a whole include the all-embracing role of scientific and technological progress. The application of new technology determines the growth of labour productivity, on which, in turn, the increase in material production depends. On the other hand, technological progress also exerts a direct influence on the people's welfare by providing them with better consumer goods.

Given the current rapid rate of scientific and technological progress, the next twenty to thirty years might bring totally new discoveries that will dictate major adjustments to forecasts and will speed up the growth of production enormously.

In forecasting, account must also be taken of the fact that, with the attainment of a higher level of production development, its future prospects will be based increasingly on determination and calculation of both individual and social needs and the order of priority according to which these should be satisfied.

The method of quotas is used increasingly frequently to calculate demands. To calculate production requirements, for example, quotas are used for different types of raw and other materials and semi-finished products. The quotas are worked out, in particular, by the Institute for Planning and Quotas under the State Planning Committee (Gosplan) of the USSR. Science-based quotas for foodstuffs consumption are worked out and used for different professions, ages and regions. There are also consumption quotas for goods such as clothing, footwear and household equipment. Such quotas are not used sufficiently and they require considerable improvement. Another possible method for determining demand is the questionnaire, a method which is as yet hardly used, though it is very promising. Finally, it is possible to study consumer demand via the retail trade network, and such methods must be used more widely.

Of enormous significance for the goals of forecasting is the development of a conception and a model of the socialist

way of life of the Soviet people. The point of departure in compiling this model must be a steady increase in the material welfare and culture of the population. The standard of living of the Soviet people must, in the future, become the highest in the world, and approximate stages for this rise can be outlined, envisaging an increase in the share of social funds in satisfying demand, development of collective forms of consumption (public catering, transport, boarding houses, etc.). This is only one side of the matter, however.

Improvement in socialist production relations at the stage of developed socialism is accompanied by a growth in the social consciousness of the people, increasing understanding of the common nature of personal and collective interests, strengthening of responsible attitudes towards national property and intolerance of grabbers and slackers. All these changes influence favourably the organisation and management of the national economy, and help increase the productivity of social labour, and must, therefore, be accelerated.

Forecasting must take account of the fact that the Soviet Union's economic development is closely linked with that of the other socialist countries. Long-term plans and forecasts being drawn up in all these countries provide for exchange of information, and co-ordination of these plans is extremely important in order to consolidate and develop socialist integration. This provides the opportunity for all the countries to benefit from division of labour, so that each country produces the goods that cost it least and the economy of one country complements that of another on the basis of various forms of co-operation and exchange (foreign trade, exchange of licences, joint construction, co-operation in production, and so on.)

Finally, a very important condition for determining economic prospects is the political situation in the world and progress in the social systems of countries and peoples. In recent decades, these have been reflected in the consolidation and growth of the forces of socialism and the collapse of colonialism. The elaboration of prospects is also based on peaceful competition between countries with different social systems.

The consolidation of peace and security necessitates the strengthening of defence in the future, which at present implies constant concern for the use of the most advanced technology to these ends, and, consequently, for its further development.

Forecasts for separate aspects of the development of society must be distinguished. These forecasts have their own features, but, at the same time, they are closely interconnected and interdependent. The following are some of these aspects. Forecasts for the development of production and consumption, their trends and structure are the basis for economic forecasting and, at the same time, must proceed from the development of other aspects of the life of society. Social forecasts of the development of production relations, culture, and education are largely determined by the growth in production and consumption. Demographic forecasts, covering the growth trends and migration of the population, employment, labour resources and the health services are connected with the two other types of forecast, since population growth is largely a function of production and consumption, and the material and cultural standards of the population. Forecasting the development of science and technology is extremely important for determining the growth in labour productivity and the level of consumption. Forecasts of trends in the use of natural resources—minerals, water resources and the like—are of great significance in forecasting the growth of production and are akin to scientific forecasts. Finally, future development in general is determined by political forecasts and their derivatives—forecasts of the military and strategic situation, which has a considerable effect on the economy.

Comprehensive forecasts are predictions of the consciously determined course of development of socialist society and its economy on the basis of the known laws of nature and society. This is what distinguishes forecasts compiled in the Soviet Union from those of the capitalist economy that have become so widespread in recent years. The latter are predictions of possible future development, based mainly on a study of past trends, and, at best, on assessments of expected innovations in science and technology, possible events in politics and the like.

The purpose of Soviet forecasts is to provide a basis for the elaboration of concrete development programmes for the long-term plan and for the shorter five-year plans. A correct formulation of the goals of development is of great importance. The development goals for the Tenth Five-Year Plan have been set by the 25th Congress of the CPSU, including the main target for the Tenth Five-Year Plan which consists in consistent implementation of the policy of the Communist Party to raise the population's material and cultural standards on the basis of rapid and balanced development of social production and its increasing efficiency, acceleration of scientific and technological progress, growth of labour productivity and an all-round rise in the efficiency of all sectors of the national economy. These targets are the result of the long-term economic policy determining the future trend of development.

Thus, the long-term forecast for the period extending to 1990 proceeds from a development of production that will permit a considerable increase in the population's material and cultural standards. Further steps will be taken towards socialisation and transformation of the two forms of socialist property—state and collective—into a single, national socialist property. There will be further changes in the nature of labour as it becomes a first essential, and this will have a tremendous influence on the increase in labour productivity, its quality and the responsibility each person bears for the task he is entrusted to fulfil and for the organisation where he works. As the population's cultural standard rises, the fundamental differences between mental and physical labour will be erased. Heavy, manual labour will be ousted throughout by machinery and automatic systems. There will be less and less difference between industrial and agricultural labour and between the standard of living in town and country.

CHAPTER III

THE RESOURCES FOR ECONOMIC GROWTH. THE POPULATION

1. POPULATION GROWTH TRENDS

Economic growth depends on a number of factors, the most important of which are the productive forces of society, i. e., the working masses actively participating in the production process, and the means and objects of labour used by them in the production process. Production relations, the social form of production, the production management system and the interests and stimuli for economic development exert a considerable influence on economic growth. All these factors determine, in different ways, the nature of production, its technical and social organisation, and the trends and rate of growth. At different stages of its development, society makes varying use of the productive resources at its disposal.

Productive resources constitute a broader concept than productive forces. Productive resources include, for example, the whole population, and not only that part of it which is involved in the social production process. The available population may be used in different ways to form the overall number of those employed in the various fields, including the national economy. Furthermore, productive resources cover natural resources, both used and not used in production, including minerals, the land, forests, water, the atmosphere and climate. Natural resources are a major precondition for the formation and development of productive forces. Finally, the exclusive significance must be mentioned of productive resources made by man, including all types of instruments of labour and objects of labour: mines, factories, plants, ports, roads, agriculture,

stocks of raw materials and finished products, etc. Productive resources, therefore, include active kinetic productive forces, i. e., manpower and means of production participating in the production process, plus productive forces not drawn into the production process, i. e., potential, unused manpower and natural resources, and means of production. Socialist society ensures full employment and full utilisation of productive capacities. The presence of latent manpower reserves in enterprises, the insufficient degree to which those employed in the household, pensioners and so on are drawn into production and also noninstalled equipment are a result of shortcomings in planning and management of the economy and in the assessment of production capacities.

The Soviet Union has vast natural resources—potential productive forces and a powerful reserve for further growth of socialist production.

In considering the movement of manpower, the most important of productive forces, let us turn to its prerequisite, the growth trends of the population.

From 1897 to 1976, the population more than doubled, exceeding the 256 million mark. In 1921, the population was approximately at its 1913 level, and in 1945, it fell to the 1926 level. In 1926, the natural growth of the population reached 24 per thousand, in the 1930s it was 19 or 20, and on the eve of the Second World War it fell to 13. In the post-war years, the natural growth rose to 17-18 per thousand. In the 1960s, particularly in the second half of the decade, there was a significant drop to 8-9 per thousand.

The increase in the natural growth of the population after the Second World War, the so-called compensatory wave, and the drop in subsequent years, were characteristic not only of the USSR, but also of developed capitalist countries, as can be seen from Table 5.

In almost all capitalist countries, except France, the population growth index had dropped by 1970 to a level significantly below that before the beginning of the First World War (1914), while in the USA, West Germany and Italy, the increase in 1974 was below the 1939 level. As for France, the absolute drop in the population that preceed-

Table 5

Natural Growth per Thousand of the Population

Country	1911-1913	1939	1950	1960	1970	1974
USA	11.8	6.7	19.9	14.2	8.8	5.9
Britain	10.1	3.0	4.5	6.0	4.5	1.1
France	—0.9	—0.8	7.9	6.5	6.1	4.8
West Germany	12.2	8.0	6.0	6.4	1.8	—1.6
Italy	12.4	10.2	9.8	8.6	7.1	6.1
Japan	13.9	8.8	17.9	9.6	12.0	12.1

ed both the First and Second World Wars gave way to a significant increase which, although slightly lower in 1974, is still fairly high. The population increase in the USA dropped to a level below that of the USSR, while in Japan, the increase has again gone up in recent years.

The population growth in a number of countries of Central and South America, Africa and Asia is at the present time very high. The population growth in Mexico, for example, has reached 38 per thousand, 30 in the Dominican Republic and Nicaragua, 32 in Salvador, 32 in Brazil, 31 in Peru, 32 in Colombia, 34 in Equador and 35 in Venezuela. In Africa, where the general growth is somewhat lower, it is 25 per thousand in Nigeria and Egypt, 27 in Ghana, 38 in Algeria, 28 in the Sudan, 30 in Zambia, 28 in Rwanda and 40 in Libya. Among the Asian countries, for example, in Turkey and India the growth rate is 25, 33 in Syria, 24 in Vietnam and 30 in the Phillipines. The significant increase in the population growth of all these countries in the post-World War II years is mainly a result of a sharp drop in the mortality rate. In Mexico, for example, the mortality rate dropped from 23 per thousand in 1939 to 8.2 in 1973, while the birth rate for these years rose from 44.6 to 46.3 per thousand. As a result, the natural growth rate of the population increased from 21.6 to 38.1. The picture is similar in the other countries in which the population growth rose sharply. There is a fast population growth in densely populated countries such as India and

China. In 1974, the population of India was 598 million, while the average population growth for 1971-1974 was 19.5 per thousand. No population statistics have been published in China since 1953, but estimates indicate that the growth rate of the population is hardly likely to have dropped, while the mortality rate has fallen significantly. Some experts put the population of China at between 750 and 850 million. Thus the population of both countries taken together is 1,300-1,400 million people, or one-third of the population of the earth. As a result of the high population growth rates in densely populated countries, the population of the whole world is rapidly increasing. This increase over the last few decades has been the foundation for the expression "population explosion" used by some demographers.

Table 6 shows that the absolute scale of the population growth has been constantly rising over increasingly short periods of time. It took mankind 2 million years to reach

Table 6

The Population of the World from 1 to 2000 years[1] A. D.

Year	World population	
1	230 million people	
1000	275 " "	increase of 45 million in 1000 years
1500	450 " "	" 175 " " 500 "
1800	920 " "	" 470 " " 300 "
1900	1,617 " "	" 697 " " 100 "
1950	2,486 " "	" 869 " " 50 "
1970	3,600 " "	" 1,114 " " 20 "
2000	6,000 " "	" 2,400 " " 30 "

the 1,000 million mark in 1820. The population rose to 2,000 million in only 100 years (this level was reached in 1927). The third thousand million took 30 years (up to

[1] See *The Marxist-Leninist Theory of Population*, 2nd revised ed., edited by Professor D. I. Valentei, Moscow, 1974, p. 236 (in Russian).

1960), while estimates indicate that the fourth thousand million will take no more than 15 years. The population in the year 2000 is estimated to be approximately 6,000-6,200 million. The figure 6,000 million has been put in the table on the assumption that the world population will continue to increase at the same rate as it has for the last twenty years.

The rapid population growth and the growing demand it implies, are exciting the apprehension of demographers and scientists in other fields in connection with the approaching depletion of natural resources and environmental pollution, i. e., the limited natural resources—minerals, soil, fresh water, etc.—and the increasing environmental pollution. Calculations made by computer at the Massachusetts Institute of Technology (MIT) give the following picture. If the rate of population growth, of environmental pollution and production continue at their present rate in the future, the per capita production of manufactures and foodstuffs may increase roughly into the first decade of the 21st century. Irreplaceable resources will, by that time, have been more than half-depleted, and environmental pollution is expected to reach its maximum in the second quarter of the 21st century. As a result, production will start to fall rapidly, so that at the turn of the 22nd century it will have fallen to the level of the early 20th century. In the middle of the 21st century, the population will begin to decline as a result of an increased mortality rate. The study looks at different alternatives facing the world —a doubling of natural resources, unlimited growth, control over environmental pollution, and so on. The best alternative seems to be stabilisation of population growth, limitation on output increase, strict control over environmental pollution, and so on. Under these conditions, the highest standard of living can be ensured beyond the 22nd century. These conclusions can be compared with the results of similar studies some of which have been published in connection with the Stockholm Conference on the Human Environment. In general, they differ little from one another.

Neo-Malthusian theories, the essence of which is the need to cut the birth rate, have become widespread and even receive official governmental support. Measures to cut

the birth rate are recommended, for example, by the governments of China, India and other countries. Even in the richest capitalist country, the USA, the official point of view is that an increase in the population does not, of itself, increase the economic potential of the country. If the present population growth rate in the USA is maintained to the end of the century, the population will increase by a hundred million to approximately 300 million. Such an increase will cause serious problems that are to be avoided.[1] In the US government's opinion, therefore, stabilisation of the US population at the 250 million mark is desirable at the beginning of the 21st century. To this end, families set up after 1970 should not have more than two children. Even under these conditions and a halt to immigration, the population growth will continue for another 70 years.

All these considerations and apprehensions are extremely debatable. As far as world resources are concerned, although they are not unlimited, they are in broader supply than is sometimes imagined. The so-called Green Revolution is a result of the use of high-yield wheat varieties and large quantities of fertiliser, which have greatly improved food supplies in a number of developing countries. This has shown the opportunities promised by increasing yields.

Finally, technological progress helps reduce the amount of materials and energy required per unit of output, improve the utilisation of raw materials, open up new possibilities for utilising waste and recycling water, and so on.

The conclusion that population growth means only an increase in dependents, resulting only in a rise in consumption, is hardly plausible either. Calculations show that people produce far more in their lives than they consume. For example, the national income of the USSR per worker engaged in material production is on average about 3,500

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[1] The US Commission on Population Growth and the American Future includes among these problems: (1) a lower growth of per capita incomes and increasing difficulty in finding jobs; (2) expansion of overpopulated conurbations; (3) accelerated depletion of natural resources; (4) growing need for recreation areas; (5) deterioration in food supplies, and (6) increasing environmental pollution.

rubles a year. Let us assume that in the next thirty years it will go up to an average of 6,000 rubles per year. On the basis of a 45-year working life, each worker in material production will produce an output worth $6{,}000 \times \times 45 = 270{,}000$ rubles. During a life of seventy years he will consume 70,000 rubles' worth of products, assuming a rise in consumption in the future to an average of 1,000 rubles' worth a year. To find the size of the necessary product, the amount the worker spends to feed the members of his family must be added to this. Then the consumption figure will roughly double to 140,000 rubles. The norm for the surplus product is now slightly above 90 per cent. The balance for the worker during his lifetime is about 130,000 rubles. This balance allows for accumulation, serving as the source for capital investment, for maintenance of workers in the non-productive sphere, for covering administration and defence spendings, and so on.

This shows how wrong are those who argue that population growth is undesirable because it necessitates additional expenditure. Population growth promotes economic growth. In countries with a low population density, but with vast natural resources, such as the Soviet Union, this growth must be viewed favourably from the economic point of view. To what extent natural resources can keep up with this growth is another question.

Let us look at the factors determining the rate of population growth in the USSR. A decisive influence is exerted on the natural growth of the population by the fall in the mortality rate. In the USSR, the mortality rate has dropped from 29.1 per thousand in 1913, to 8.7 in 1974. It is the drop in the mortality rate that explains the natural growth of the population in the 1920s, 1930s and right up to the beginning of the Second World War being higher than in 1913. The drop in the mortality rate is a result of progress in medicine, the health service, and protection of mother and child and of a rise in the standard of living. The mortality rate in childhood has dropped particularly sharply. Until the Revolution, 43 per cent of babies died before they reached the age of five, and the average life expectancy was only 32 years (according to the 1897 census). In 1970, only 3.3 per cent of babies died before the

age of five, and the average life expectancy rose to seventy years. As a result of the higher life expectancy, the population of the USSR has aged somewhat, as shown by Table 7.

The share of the junior age groups has fallen, while that of the older ones has risen, as a result of which the average age of the population has increased. According to Prof.

Table 7

The Share of Different Age Groups in the Population of the USSR (per cent of total)[1]

Age group	1939	1970	1975
0-9 years	22.8	18.6	16.5
10-19 "	21.7	19.5	19.5
20-29 "	18.0	12.8	15.3
30-59 "	30.7	37.2	35.4
60 and above	6.8	11.8	13.3
Total	100.0	100.0	100.0

B. Urlanis, the arithmetic mean of the age of the population rose from 25.1 years in 1926 and 26.4 in 1939, to 29.6 in 1959 and 31.4 in 1970. The proportion of elderly people in the Soviet Union is still smaller than in a number of other countries: in the USSR—13 per cent, in the USA—14 per cent, and in France and Britain—19 per cent.[2]

The increase in the average age of the population, i.e., the ageing of the population, leads to an increase in the mortality rate per unit of the population. On the other hand, the birth rate is falling. In 1913, it was 45.5 per thousand of the population, 44 in 1926, 31.2 in 1940, 26.7 in 1950, 24.9 in 1960, 17.4 in 1970 and 18.1 in 1975.

What are the reasons for the drop in the birth rate?

To answer this question, the factors influencing the birth rate must be studied. At first glance, it seems that the birth

[1] See *The National Economy of the USSR in 1973*, p. 33.

[2] See B. Urlanis, *Problems of Population Growth in the USSR*, Moscow, 1974, p. 213 (in Russian).

rate must depend on the welfare of the population: the higher the living standards, the higher the birth rate must be. Reality shows the opposite: the birth rate is high when living standards are low and, as these standards rise, the birth rate falls. More prosperous people usually have fewer children than poor people, and city dwellers have fewer than those who live in the countryside. The cultural level, too, exerts its influence on the birth rate. What is the reason for this seeming paradox? A number of contradictory factors stand behind it. To bear children is one of man's natural needs, without which the human race would long since have died out. There are, however, numerous other needs, both material and spiritual, and bearing children occupies only one place among them. This place may be low or high in the order of priority depending on the number of needs, their urgency and significance for a person, and the degree to which they are satisfied also differs considerably. The number of requirements being small, the need to bear children occupies one of the top places, and this need always exists. As new needs arise and are satisfied, the need to bear children is pushed into the background, while the needs to improve living conditions, education, culture and social activity come to the fore. Bearing children makes it more difficult to satisfy these new needs, and the result is a self-imposed limitation on child-bearing, especially when the conditions for bringing up children create difficulties for the parents and hamper the satisfaction of other needs that they may consider more vital. Once these needs are satisfied at a higher standard of living, the birth rate may again go up.

The inverse relationship between the material and cultural level of the population and the birth rate is seen in the proportion of births among different groups of the population according to income size, among the urban and rural population, among relatively developed and backward peoples. Thus, the number of births in rural areas per thousand exceeded that in the cities in 1918 by 62 per cent, in 1926 by 35 per cent, in 1940 by 9.5 per cent, in 1950 by 4 per cent, in 1960 by 27 per cent, in 1970 by 14 per cent and in 1975 by 12 per cent. If one allows for the influence of the different age and sex structures of the urban and ru-

ral population on the birth rate, according to V. I. Perevedentsev[1], the birth rate in the countryside is 50 per cent higher than in the town. Moreover, the share of the rural population in the USSR is falling year by year: from 82 per cent in 1913 to 67 per cent in 1940 and 38 per cent in 1976.

A factor causing the birth rate to fall is the high proportion of women employed in social production.

The increase in the number of working women is only partially the result of material necessity and increasingly

Table 8

The Growth in the Number of Working Women

	1928	1940	1950	1960	1970	1975
The number of female factory and office workers, millions	3	13	19	29	46	53
As percentage of the total number of factory and office workers	24	39	47	47	51	51

of their desire to apply their knowledge and skills in social production. In the Soviet Union, the number of women with higher and secondary specialised education has increased significantly. In 1960, there were 5.2 million of them, while by the beginning of 1976, their number had risen to 13.4 million. The birth rate is falling with the rise in the education level. In the Russian Federation, for example, there are 1,550 children for every thousand mothers with uncompleted higher or secondary specialised education. compared with 2,182 children for every thousand mothers having primary education.[2]

[1] See *The Population and Labour Resources of the USSR*, ed. by D. I. Valentei and I. F. Sorokina, Moscow, 1971, p. 152 (in Russian).

[2] See *Labour Resources and the Scientific and Technological Revolution*, Moscow, 1974, p. 172 (in Russian).

At the same time, the considerable difficulties in running a household (the preparation of food, housework, shopping, washing, etc.) are the heaviest for working women, and grow still more with the number of children, to say nothing of the physiological aspects. Hence the need for improving supplies, developing public catering and household services, producing various types of household appliances, as this might be of considerable significance in increasing the participation of women in production and creating the conditions to facilitate their fulfilment of the important social functions of bearing and bringing up children.

This is why, during the Ninth Five-Year-Plan period, considerable attention was devoted to retail trade, public catering and services. During the five years, retail turnover rose by 36 per cent, the capacity of catering establishments by 40 per cent, and the volume of services by 60 per cent.

During the Tenth Five-Year-Plan period, services easing home chores and improving the leisure of Soviet people will be further increased both as regards their volume and range. The volume of services will go up 50 per cent (70 per cent in rural areas). Retail turnover will rise by 27-29 per cent.

One of the factors that has a positive effect on the birth rate is improved housing conditions. Professor B. Urlanis drew attention to a likely connection existing between housing and the birth rate, although actual data suggest only a weak relationship.

Measures are being taken in the USSR and other socialist countries to stimulate the birth rate. In the USSR, for example, since 1974 child allowances have been paid to families in which the average income per family member is less than 50 rubles a month. The number of paid days for looking after a sick child has been increased and pre- and post-birth leave is now paid at full scale, irrespective of the duration of the woman's work record. More and more kindergartens and creches are being built. Families with many children enjoy the greatest benefit. In a number of countries, allowances to mothers are very high. In Hungary, for example, these measures have resulted in the

birth rate rising from 13 per thousand in 1965 to 17.8 in 1974; in Czechoslovakia it increased in the same period from 16.4 to 19.8.

It must be remembered that the effectiveness of measures to increase the birth rate depends to no small extent not only on incentives to families with many children (four or five), of which today there are few, but also to families with three children. There are many such families and an increase in their number could have a big effect on the overall growth of the population.

For individual Union Republics, the lowest growth figures in 1975 were for the RSFSR (5.9), the Ukraine (5.1), Byelorussia (7.2) and also the Baltic republics: Lithuania (6.2), Latvia (1.9) and Estonia (3.3). In the last two republics, as a result of the high proportion of old age groups, there is a high mortality rate (12.1 and 11.6 respectively).

The highest natural population growth has been recorded in the Central Asian republics: Uzbekistan (27.3), Turkmenia (26.6), Tajikistan (29.0), Kirghizia (23.3) and Kazkhastan (17.0), and also Azerbaijan (18.1) and Armenia (16.9) in the Caucasus. Turkmenia, Uzbekistan, Tajikistan and Kirghizia have the highest birth rates in the USSR of between 30.4 and 37.1 per thousand inhabitants. In 1975, however, the birth rate had fallen in comparison with 1940 and even 1960 in all the Union Republics. The only exception was Tajikistan, where the birth rate rose from 30.6 in 1940 to 33.5 in 1960 and 35.6 in 1973. The lowest mortality rates are found in Armenia (5.5), Uzbekistan (7.2), Kazakhstan (7.1) and Azerbaijan (7.0).[1]

Characteristic culture, way of life, customs and to a certain extent, climate, tell on differences in the birth and mortality rates and natural growth of the population, being considerably greater in the South than in the North and West of the country. In the Central Asian republics, for example, girls marry at a much earlier age than in the other republics and the marriageable age here is fixed at sixteen by law.

The influence of national specifics on the size and fluctuations of the birth rate needs to be studied specially. There have been significant shifts in the distribution of the

[1] See *The National Economy of the USSR in 1975*, pp. 42-43.

population according to the regions of the country. On January 1, 1974, for example, 53 per cent of the population lived in the RSFSR, while in 1959 and 1940 the figures were 56 per cent and 56.5 per cent, respectively. The share of the central zone of the RSFSR has dropped particularly sharply from 37 per cent in 1940 to 30.1 per cent in 1974, while the share of the Urals, Siberia and the Far East rose from 14.5 per cent in 1940 to 17.7 per cent in 1959, and then dropped to 16.5 per cent in 1974. The North Caucasus showed a significant increase from 5.1 per cent in 1940 to 5.9 per cent in 1974.

The share of the Ukraine in the total population dropped from 21.2 per cent in 1940 to 19.4 per cent in 1974. The figures for Byelorussia are 4.7 and 3.7 per cent, respectively, for the Baltic republics 3 and 2.8 per cent, while for Central Asia, Kazakhstan and Transcaucasia there was an increase from 12.9 to 19.6 per cent.

These changes in the distribution of the population are due not only to differences in the birth and mortality rates, but also to migration. During the Great Patriotic War (1941—1945) and a few post-war years, migration flows were directed to the East, resulting in an increase in the share of the Urals, Siberia and the Far East. During the last decade, there has been a migration out of the Urals and some regions of Western and Eastern Siberia, and in the European part of the USSR, from the Volga-Vyatka area northeast of Moscow and the areas south of Moscow. There has been a population inflow into the North Caucasus and the Ukraine, and in the Asian part of the USSR, into Kazakhstan, Central Asia and the Far East.

Between 1959 and 1973, the share of Western Siberia in the total population of the USSR fell from 5.4 to 4.9 per cent, that of Eastern Siberia remained unchanged (3.1 per cent) and that of the Far East increased, though slightly, from 2.3 to 2.5 per cent. Between 1959 and 1973, roughly a million more people left Siberia than settled there. This population movement has a negative effect on the development of these regions of great economic potential.

A number of economic measures are being introduced to stem the population outflow from these regions, promote an influx and settlement there. For example, the wage rate al-

lowances in some industries in the Far East and in Eastern Siberia have been raised, and allowances have been introduced to raise wages in areas where they have not previously been paid. The construction of housing and social and cultural centres is developing extremely rapidly in these regions.

During the Tenth Five-Year-Plan period, allowances to wage rates are being introduced for length of work record in the Far East.

All this necessitates capital investment of 3,000 to 5,000 rubles per inhabitant in new urban communities and 2-3 times more in the North. This investment is essential, however, in order to supply the important regions of the Urals and Siberia with the necessary manpower.

On the other hand, changes in the direction of migration flows will make it possible to reduce or halt the undesirable population influx into regions with surplus manpower resources such as the North Caucasus, the Ukraine and Central Asia. The influx into Kazakhstan is a different matter, as the area has great economic development prospects, particularly in the extractive industry.

Changes also take place in the population distribution within economic regions when the population grows rapidly owing to the establishment of new industrial units. For example, the population of Western Yakutia increased in connection with diamond mining; of Chukotka where gold and non-ferrous metals are mined; of Tyumen Region and Mangyshlak because of the development of the oil and gas industry. The favourable living conditions created in these regions have promoted the population influx.

A study of population growth rates and the factors responsible makes it possible to calculate the natural population growth for the future. For this, data are needed on the numbers in different groups of the population with a break-down by age (by year, the beginning of the reproductive period for each group and possible birth-rate fluctuations). With these data, it is possible to determine the number of potential births each year, and also the total population for each year in the future. The farther into the future, the greater the deviations might be, and in the more distant future these might be as high as 5-10 per cent.

This is a considerable difference, bearing in mind that differences in manpower resources and also in the volume of production and consumption, depend on this.

A less accurate method can be used for calculating the approximate population figures, on the basis of various sets of figures reflecting the possible average population growth. For example, there are three possible ways for forecasting population growth to the end of this century: (1) the current rate of population growth (approximately 8 per thousand of the population each year) will hold on; (2) this figure rises to 9, and (3) this figure decreases to 7. In the first case, the Soviet Union's population in the year 2000 will be 310 million, 318 million in the second and 302 million in the third.

How much more population does the USSR need? Is an active demographic policy needed? Should the aim be as large a population as possible or should it be limited?

An active demographic policy is essential in a planned economy, and the state must decide what population growth it will need. For the population to rise, the average number of children per married couple must be more than two, depending on the number of single and childless people. In turn, this means that measures must be taken to stimulate the birth rate. The task is certainly not limited to attaining a specific increase in the total population.

It is of prime importance for the country, for example, for its northern and eastern areas, Siberia and the Far East, with their vast territories and rich natural resources, to be settled more rapidly. This target cannot be achieved by the total population increasing or decreasing—special measures are needed to promote migration to these areas.

On the other hand, the very low population growth in the central areas of the RSFSR, the Ukraine, Byelorussia and the Baltic republics is cause for concern. Here, measures are needed not to stimulate migration but to raise the birth rate. In the Central Asian republics, the birth rate is high enough and does not need stimulating. On the whole, it would hardly be expedient to aim for a population growth of more than 1 per cent a year. The well-known French demographer, A. Sauvy, spoke in his report to the Conference of the International Economic Association in 1973 in

Valescure (France) that, according to his calculations, taking account of employment, the increase in the national income and other factors, the most suitable population growth for developed countries would be 0.5 to 1 per cent a year. The most probable population figure for the USSR in the year 2000 is somewhere above 300 million.

Changes in the urban and rural population figures will continue to take place in the future. In 1976, the urban population was 60 per cent larger than that of the countryside and, by the end of the century, it will be 100—150 per cent larger.

2. MANPOWER RESOURCES

The total labour force employed in the national economy, not including servicemen, students, housewives, dependents and pensioners, was 119 million in 1975, or 46 per cent of the USSR population (against 34 per cent in 1940).

Table 9 shows a decrease in manpower employed in material production over the last 35 years due to a fall in the number of those working in agriculture, the share of which (together with forestry) dropped from 54 per cent in 1940 to 24 per cent in 1975, and in terms of numbers, from 32 to 28.5 million. In all other branches of material production, the labour force has grown, the share of industry going up to 28.6 per cent. At the same time, the number of workers in the non-productive sphere has increased significantly: its share rose from 13 per cent in 1940 to 21.9 per cent in 1975. In education, the health service, science and art by far the greatest increase has been registered—from 7.2 to 16.3 per cent.

One might assume that the same trends that have been observed in recent years will continue in the future. The proportion of those employed in agriculture will continue to fall as the productivity of labour rises in this sector, while that of the labour force in industry, transport and, perhaps, in construction, will rise. The share of trade, public catering and supplies will also go up, but the numbers employed in the non-productive sphere—services, education, the health service, science and culture—will rise particularly fast.

Table 9

The Distribution of Employment Grouis in the Productive and Non-Productive Spheres*

	1940		1950		1960		1970		1973		1975	
	mill.	%	mill.	%	mill.	%	mill.	%	mill.	%	mill.	%
General total	65.8	100.0	71.8	100.0	88.6	100.0	111.9	100.0	115.2	100.0	118.7	100.0
Including:												
Industry	13.1	19.9	15.3	21.4	22.6	25.5	31.6	28.2	32.9	28.6	34.0	28.6
Agriculture and forestry	34.9	53.1	34.8	48.5	32.5	36.7	29.4	26.3	29.0	25.8	28.5	24.0
Transport and communications	3.9	5.9	4.6	6.4	7.0	7.9	9.3	8.3	10.2	8.8	10.7	9.0
Construction	2.0	3.1	3.3	4.6	6.3	7.1	9.1	8.2	10.1	8.7	10.6	8.9
Total	53.9	81.9	58.0	80.9	68.4	77.2	79.4	71.0	82.2	71.3	83.8	70.6
Trade, public catering, procurement and material supply	3.3	5.0	3.3	4.6	4.7	5.3	7.5	6.6	8.4	7.3	8.9	7.5
Total in material production	57.2	86.9	61.3	85.5	73.1	82.6	86.9	77.6	90.6	78.6	92.7	78.1
Non-productive sphere	8.6	13.1	10.5	14.5	15.5	17.4	25.0	22.4	24.6	21.4	26.0	21.9
including:												
Education, health service, science and art	4.8	7.2	6.3	8.8	10.4	11.7	16.7	15.0	18.4	16.0	19.4	16.3

* See *The National Economy of the USSR in 1972*, pp. 406, 504-05; *The USSR in Figures in 1973*, pp. 162-63; *The USSR in Figures in 1975*, pp. 171, 174-77 (in Russian).

On the whole, the fall in the proportion of the labour force in production and the rise in the non-productive sphere is a result of the growth of social labour productivity: the higher labour productivity and the more developed material production, the higher is the degree to which demands for food, clothing and housing are satisfied and the greater the proportion of social labour that can be devoted to the services, to science and culture.

In the USSR, the labour force employed in the non-productive sphere increased from 8.6 million in 1940 to 10.5 million in 1950, 15.5 million in 1960, 25 million in 1970 and 26 million in 1975. In 1975, the total labour force in the national economy rose by 34 per cent over 1960, the increase in the non-productive sphere was 67 per cent and in material production, 27 per cent. The labour force in the non-productive sphere will continue to grow faster than that in material production in the future, too. At the same time, more people will be employed in the services, especially in education, science, art and the health service, satisfying those requirements of society that will come increasingly to the fore as it advances towards communism.

The number of workers in material production will not only increase more slowly than that in the non-productive sphere, it will also be differently distributed according to sectors. At present, industry shows deceleration of labour force growth rates and will continue to do so, so that even the number of workers might climb down. This depends on the rate of increase of labour productivity, meaning technological progress. In the fuel industry, iron-and-steel industry and forestry, the number of workers has stabilised or is falling, while in engineering, the chemical and petro-chemical industries, the number of workers can increase.

In the future, the numbers employed in transport and communications will also rise, particularly as a result of the planned rapid development of road transport, in which labour productivity is still somewhat lower than in rail transport. Construction is yet another sector of the economy that might require more workers.

As agriculture is supplied with advanced machinery, production efficiency is raised and labour productivity

rises significantly, less hands will be required. People no longer needed in agriculture will be engaged in other sectors of the economy. Between 1959 and 1970, 16.4 million people moved to the towns. The share of the country dwellers in the total population of the USSR fell from 51 per cent to 41 per cent. Nearly 20 per cent of the total increase in the labour force employed in the non-agricultural sectors of material production between 1950 and 1975 was supplied by the outflow of manpower resources from agriculture.

The most important task in the development of manpower and its efficient utilisation is the training, retraining and distribution of the labour force in line with the requirements of technological progress. The speed of technological progress largely depends on the supply of skilled workers, engineers and scientists. The introduction of increasingly complex machinery into production places a steadily growing demand on the people who operate it. This implies raising the general education level, training managerial staff, skilled workers, and creating new specialities. These issues will be discussed in more detail in Chapter VI.

Shortages of manpower are alleged to be felt frequently, especially in large industrial centres. There is indeed a shortage of manpower in new developing regions: in Siberia, the Far East and the North. In traditionally developed regions, however, it is rather misuse of manpower and inadequate planning, as a result of which there are latent reserves of manpower in enterprises, and insufficient utilisation of manpower in small and sometimes in medium-size towns and in individual regions of the country.

Reserves of manpower are to be found in Moldavia, the North Caucasus, the Transcaucasian republics and Central Asia. These reserves can hardly be utilised to any large extent by resettling people in other regions. Evidently, new job vacancies must be created in areas with labour surpluses and attempts made to halt migration to these republics and regions.

The employment level of the population in small and medium-size towns, in which roughly a quarter to a third of the urban population live, can be greatly increased. Many of these towns are not sufficiently developed in economic

terms. In the Central region, for example, slightly over 20 per cent of the gross industrial product is produced in towns with up to 50,000 inhabitants, including about 8.3 per cent produced by towns with up to 20,000.[1] The development of industry in these towns will make it possible to utilise available manpower, will further economic development and improve the demographic structure. In particular, the proportion of the male population can be increased in textile centres and small and medium-size towns, which will raise the number of marriages and the birth rate in these towns and reduce the share of the older age groups.

When choosing locations for new enterprises, account must be taken of the sex composition of the workers. For example, in towns where mainly women are employed in industry (such as Ivanovo and Shuya), new enterprises should be set up to employ men, and in towns where enterprises employ mostly men (in the metallurgy and coal-mining of the Donbas and Dnieper area, for example), it would be desirable to set up new enterprises employing female labour.

The development of large cities is, of course, a more complex task than is usually imagined. Population concentration in large cities is generally considered to be an unwelcome choice as this leads to a growth of municipal expenditure, longer travel time, and time spent on other routine matters, to a fall in the birth rate, etc. However, this leaves out of account the advantages of life in a large city in the way of culture, health service, sport, entertainment, employment, and so on. All these facilitate the attainment of important social goals, the development of the individual and an improvement in the standard of living.[2]

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[1] See *The Population and Labour Resources of the USSR*, p. 122.
[2] See *ibid.*, p. 153 et seq.

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CHAPTER IV

THE RESOURCES FOR ECONOMIC GROWTH. THE NATURAL ENVIRONMENT

1. THE ROLE OF THE NATURAL ENVIRONMENT IN ECONOMIC DEVELOPMENT

The natural environment covers geographical situation, terrain, climate, minerals, soil, forests, water, and is the underlying condition for production. Production involves interaction between nature and society, during which society subordinates natural forces and natural resources to satisfy its needs. Natural resources are the source from which all the material benefits comprising the social wealth are formed. The expenditure of labour on the manufacture of products depends largely on the quantity of natural resources that can be utilised. The richer the natural resources are and the easier they are to obtain, the lower the expenditure of labour on production and the greater the amount of output that can be derived with the given expenditure.

The significance of the natural environment varies at different stages of social development. At earlier stages, natural resources directly determining the conditions of survival, such as climate, soil, forests and water with their vegetation and wild life are particularly important. Later, geographical position, terrain, seas and rivers which influence exchange and the social division of labour, acquire increasing significance. At even higher stages of development, the role of minerals becomes vital. In this way, potential natural resources are activated at different stages of social development and are utilised differently during these stages.

The natural resources of the Soviet Union are diverse and great, a factor which favours economic growth. The

existence of rich deposits of minerals, of fertile soil, vast expanses of forest and fresh water facilitated the rapid economic growth of the country in the years following the October Revolution in 1917. Thanks to the advantages of the socialist system, and the initiative and energy of the Soviet people, the productive use of these resources has increased manyfold over a short period of time to put the USSR in second place in the world in economic development, and created the conditions for further rapid economic growth.

Problems connected with natural resources and their use have become particularly pressing during recent years. In our age of scientific and technological progress, production is expanding rapidly. Against the background of a high rate and scale of industrial development, and the growing volume of raw materials and fuel processing, rational use of natural resources to achieve both the economic and social goals of developed socialist society becomes increasingly important.

This is why the problem of a comprehensive study of resources, their size, and economic efficiency, utilisation prospects and priorities, extraction methods, interchangeability of resources, their recycling and conservation, is particularly pressing. Possible efficiency and necessary outlays must be calculated and compared. A more rational, economical and careful use of natural resources usually necessitates increased expenditure which is paid back in the long run with more resources available in the future and some social, as well as economic tasks solved, such as keeping air and water pure, preserving fertility of the soil, and protecting forests with their vegetation and wild life, i. e., all that is required for the all-round development of man, his culture, talent, health and energy. For this reason, measures to conserve natural resources for present and future generations, meaning their efficient and rational use, have now been raised to the top-priority level in the Party's and government's economic policy.

Instructions included in Party and government documents on increasing protection of the environment and improving the use of natural resources, and in laws under-

lying the basic principles of land and water legislation and a number of others, lay the necessary foundations for including the study, exploitation and comprehensive use of natural resources in national economic plans as a tribute to the enormous role played by the natural environment in the development of production, improvement of health and raising of the living standards of the Soviet people.

In this connection, further improvement of production planning is of tremendous significance. Planning taking account of resources and the demand for the final product extends the opportunities for making more rational use of raw materials. Once the demand for the final product has been established, it is possible to determine which are the most suitable raw materials—natural or artificial, organic or inorganic—for satisfying a particular demand, according to what is available. In turn, this makes it possible to select the most economic and suitable raw materials and their optimal combinations for a given purpose, taking account of the prospects for scientific and technological progress. To improve electric power generation, for example, it would be expedient to raise the share of such a progressive source of power as nuclear fuel, which would allow oil and gas to be used largely as chemical raw materials, but at the same time would increase the demand for uranium. The increasingly widespread application of plastics, chemical fibres and synthetic materials provides an opportunity to reduce the demand for steel, natural fibres and so on. Improvement of national economic planning methods increases the possibility of including natural resources into the planning system and developing this system more fully.

The growth in the output of the final product depends on increasing extraction of raw materials. In Soviet times, more than 6,000 million tons of oil have been extracted, 15,000 million tons of coal and 5,000 million tons of iron ore. Thousands of millions of tons of building materials have been quarried, more than 13,000 million tons of timber have been felled, 4,000 million tons of grain harvested and more than 280 cubic kilometres of water are used annually. The gross weight of raw materials extracted is now approaching 5,000 million tons a year and is growing at

an ever increasing rate. For example, more than half the oil, coal and iron ore obtained during Soviet times was extracted between 1965 and 1975. Even more raw materials will be required in the future. To ensure the growth of production in the future, considerably more raw materials will have to be obtained. By the end of the century, it is forecast that the extraction of raw materials will have increased by 200 per cent or more.

The question arises as to whether the enormous, increasing demand for raw materials can be satisfied by the resources available. Many natural resources, minerals in particular, are not replaceable at all, while replaceable resources, such as forests, soil and water, often require very long periods to be restored. Even now, no few natural resources have already been worked out or are nearly depleted (the oil on the Apsheron Peninsula, at Grozny, Maikop and Emba, the iron ore of Mount Magnitnaya, commercial timber in the North-Western areas of the USSR). With the increasing scale of production, iron ore with a low iron content began to be used, oil is now being extracted from greater depths and from the sea-bed, and timber is felled in remote areas. The area of ploughed land has increased. In a number of densely populated industrial regions in the USSR, and also in important agricultural areas, a shortage of fresh water has begun to be felt.

In recent years new resources have been discovered and brought into use: oil in Tataria, Bashkiria and Western Siberia; natural gas in Central Asia, Western Siberia and Yakutia; iron ore at Kursk (the Kursk Magnetic Anomaly); potassium salts in Byelorussia; diamonds in Yakutia; gold in Central Asia and Transcaucasia, and many other minerals. Virgin and fallow land has provided more arable land, and many areas of the Central and Volga regions and Central Asia have had their supplies of water improved. The Soviet Union's natural resources have been investigated far from fully and more major new discoveries can be expected.

Data available on geological deposits of minerals, forest reserves, and land and water resources in the USSR show that, in the future, the country will be supplied with all the main types of natural resources. These must be used

rationally, carefully and economically, and to this end, they must be covered by comprehensive national economic planning.

2. MINERAL RAW MATERIALS AND FUEL

The USSR has the world's largest deposits of coal, iron and manganese ores, natural gas, polymetallic ores, some varieties of agrochemical raw materials and other minerals. Remaining reserves in the Soviet Union exceed the annual extraction rate: for coal 600 times (and geological deposits are a dozen times greater), for iron and manganese ores and gas, hundreds of times. The figures are similar for many other minerals, including potassium salts and chromite.

In terms of supplies of minerals, the USSR is in a better position than the developed capitalist countries, in which the shortage of fuel, in particular oil and gas, is becoming increasingly acute and an intensive fuel crisis is setting in. In the USA, known oil deposits will suffice for 11 years and gas deposits for 12 years, while in Canada, the figures are 18 and 25 years, respectively. In Venezuela oil will last for 10 years. Most of the world's oil resources are situated in the Middle East: Saudi Arabia, Iraq, Iran and the Persian Gulf emirates. Oil and gas have been discovered in relatively small quantities in the North Sea (between Britain, Norway and Holland). Japan depends on imported oil.

Capitalist countries are better supplied with iron ore. At the present rate of extraction, deposits will last for 80 years in France, for 70 years in Sweden and 250 years in Great Britain. The USA, Canada, Brazil and India have large iron-ore deposits.

The European capitalist countries and the USA are poor in many types of mineral, and so these countries have to depend on imports. Apart from the USSR (which has 75 per cent of the world's known deposits), there are deposits of manganese ore in India, Gabon and Brazil. There is chromite ore in South Africa and Rhodesia (80 per cent of world deposits), and nickel in Canada, New Caledonia and Australia (two-thirds of world deposits), and also in the Philippines and Indonesia. Bauxites are found in Guinea and Australia (more than two-thirds of world deposits). There

are also a number of deposits of these minerals in the USSR, besides which there are considerable quantities of minerals in the country yet to be discovered during future geological surveys.

Apart from minerals, the Soviet Union is also rich in other natural resources. The area of arable land in the country, for example, is larger than in any other country. The forests contain the biggest timber reserves in the world, particularly of coniferous woods (half the world's reserves). Reserves of fresh water are also very large. Lake Baikal alone contains as much water as all the American Great Lakes put together. The USSR also has the largest river drain-off in the world.

At the same time, the rapid growth of production in the future will necessitate the use of new natural resources, particularly in the North and East of the country. Raw materials will be extracted in new areas, the extraction costs of some of them will increase and large capital investment will be needed to extend their exploitation, even if related investments are not counted.

The first place in the world's output of the extractive industry is held by the oil industry, which accounts for 40 per cent of the total value of extracted minerals. In the USSR, the share of oil and gas in the total fuel extraction and utilisation balance has changed significantly in recent years. By 1970, in volume of output (of conventional fuels) oil had moved into first place thanks to the discovery of large deposits in the Urals and Siberia. Increasing quantities of natural gas are also extracted each year in the North, Western Siberia and Yakutia.

More than half the forecast coal deposits and more than a quarter of the proved reserves in the world are situated in the Soviet Union, much of coal lying at small depth and being mined by the open-cast method, which helps reduce extraction costs considerably (in the Kansk-Achinsk field, for example, the cost is 1 ruble 20 kopecks a ton, while the average for shaft mines is seven to twelve rubles).

The largest coal-fields are in the Asian part of the USSR, in Siberia and Kazakhstan, which means that a major task for the future is to find ways of delivering coal or electric power from those areas to the European part of the USSR.

Among other types of fuel, peat, combustible shale and wood are of limited significance, and their reserves will last, at the present rate of exploitation, for a long time.

The role of nuclear power will increase in the future.

Speaking of fuel and energy resources, hydro-electric power must not be forgotten. The increasing use of hydro-electric power, particularly in the Asian part of the USSR, makes it possible to keep its share in the primary energy production at roughly the present level.

The USSR has iron-ore deposits that will suffice even for the far distant future (half the world's geological deposits). In the area of the Kursk Magnetic Anomaly, in which most of the proved deposits are found, the cost of open-cast iron ore extraction is very low, approximately 1 ruble 50 kopecks a ton (while the cost of shaft mining is 50 per cent higher even for rich ores). Besides ores with a high iron content, the mining of less concentrated ores such as iron quartzite and titanium magnetites will have to be increased.

There are also sufficiently large quantities of many non-ferrous metals to be found in the Soviet Union. Geologists are faced with the task of prospecting in order to increase known reserves. Surveys are essential for some non-ferrous metals, in particular tin, tungsten and mercury. It is also important to eliminate the considerable losses that result from incomplete recovery of raw materials. Comprehensive use of the raw materials found in polymetallic ores must also be achieved.

Some plentiful minerals can be substituted for others, on the condition that efficient processes are developed for their utilisation. In particular, there are large deposits of alunites and nephelines that can be used instead of bauxites, of which there are limited deposits,in the production of alumina. Methods must be found to concentrate carbonate and oxidised manganese ores so that the large deposits of these minerals might be utilised.

Geological deposits of phosphates and potassium salts are large enough and prospecting reveals new deposits, such as those of potassium salt in Byelorussia. Fuller use can be made of the apatites of the Kola Peninsula.

The extraction of minerals with a decreased productive content and from deep-lying horizons raises the assets-out-

put ratio of the extractive industry. A decrease in both the assets-output ratio and production costs can be achieved through expansion of open-cast mining. According to available calculations, 75 to 80 per cent of ore minerals could be extracted by the open-cast method. Everything possible must also be done to cut losses of raw materials during mining. For example, more oil remains in the earth than is extracted, 40 to 50 per cent of the volume of hard minerals mined is left behind, and timber waste left in the forest is equal to a third of the amount used in the economy. In order to increase the efficiency of raw material extraction better use must be made of wastes and by-products. This will, of course, necessitate capital investment, which will be recouped many times over within a very short period. One of the most important factors in improving the utilisation of raw materials is their careful expenditure. The growth of raw material extraction must be relatively lower than the growth in the final product, thanks to economies of raw materials per unit of output.

Economic evaluation of natural resources can also be of considerable significance for a thrifty attitude towards them.

The evaluation of natural resources as a specific part of the national wealth must be taken into account not only in planning and designing, but also in providing an incentive to enterprises. At the present time, enterprises pay for the productive assets on their books, while they receive natural resources free of charge. As a result, they prefer to make more economical use of assets, sometimes to the detriment of natural resources. If enterprises had to pay for natural resources, they would be more thrifty with them, just as they are with productive assets. This does not mean, however, that all natural resources should be paid for. A special problem, for example, is how payment should be made for land and water. However, the significance of evaluations of natural resources must not be exaggerated. The main way of using natural resources rationally lies not in their evaluation or payment for them, but in planning their all-round use on a country-wide scale, making sure they are utilised economically.

Evaluation of mineral deposits might be based on the method of rent capitalisation, depending on deposits,

natural conditions for extraction and efficiency standards, taking account of the costs of exploiting the worst plot. These calculations are made more complex, however, by the fact that deposits at any location are in any case limited and, given the annual extraction rate, they can only be used up over a specific period of time. This means that the rent will also be received throughout this period. Moreover, the scale of mining and rents change over time: at the beginning mining increases, and then, having reached a certain maximum, it begins to fall until that part of the deposit which it is economically expedient to extract is fully depleted.

If the total rental sum received from the sales of the raw material throughout the period of its extraction is divided over the number of years it is exploited, the result is an average annual rent, and on this basis, the deposit can be evaluated according to the formula

$$P = R_{\text{av.}} \left[\frac{(1+E)^t - 1}{E\,(1+E)^t} \right]$$

where P is the evaluation of the deposit;
R is the average annual rent;
E is the norm of the capital investment efficiency;
t is the exploitation period of the deposit.

Since the rent changes from year to year depending on the volume mined, in order to obtain the total sum of rent, taking into account that it is received at different times, the rent for each year must be reduced to the first year of exploitation, using the coefficient $\frac{1}{(1+E)^t}$, where t is the period over which rent is received. The total rent, reduced to the first year, will equal

$$\sum R_{\text{red.}} = \sum_{1}^{t} \frac{r_t}{(1+E)^t}$$

where r_t is the actual rent received for a year.

The average reduced rent will be $\frac{\sum R_{\text{red.}}}{t}$ and this quantity should be substituted for $R_{\text{av.}}$ in the formula above.

Since actual rent received is the given quantity used in the formula, so the quality of extracted minerals, the con-

tent of the useful component in the material, the location of the deposit and other factors affecting the efficiency of its exploitation are also taken into account.

The value of deposits calculated in this way must be included in the balance sheet of enterprises in the extractive industry as a part of their fixed assets. Then the enterprise will have to add deductions from the value of the deposit to the payment for its assets. This will act as an incentive to the enterprise to recover the raw material as fully as possible. In our opinion, evaluation of and payment for a deposit are important additional levers to basic planning of mining and utilisation in improving the use of natural resources.

3. LAND RESOURCES

The USSR has an enormous area of agricultural land, which on November 1, 1975, consisted of 604 million hectares, or more than a seventh of the world total. Of this area, 226 million hectares are arable land, i.e., more than a seventh of the world total of arable land. There are 320 million hectares of pastureland and 43 million hectares of hayfield. The vast plains, with arable land, meadows and pasture, favour the development of agriculture. The central belt in the RSFSR, Moldavia, the Ukraine, the North Caucasus, the Middle Volga and the South Urals are famous for their highly fertile black earth. The podzol soils of the central and northern regions and the chestnut soils of Kazakhstan and Siberia are also fairly fertile.

However, when comparing the USSR with other countries, it must be remembered that agriculture in the Soviet Union, on the whole, is placed in less favourable climatic conditions than in the USA, European and other countries with developed agriculture, and that more labour is required per unit of output. In fact, about 58 per cent of the Soviet Union falls within cold regions, and 15 per cent is desert or semi-desert. There are also about 150 million hectares of water-logged land and marsh. Melioration of these lands might increase the area of meadows and pastures by up to 30 million hectares and that of arable land by up to 17 million hectares. There are favourable agricultural condi-

tions on 25 per cent of the territory of the USSR, but the land used for agriculture is situated in much higher latitudes than that of Western Europe, the USA and China, to say nothing of India or Egypt. The major agricultural areas of the USSR—the Ukraine, the North Caucasus, the Middle and Lower Volga, the South Urals and North Kazakhstan—are situated between 45° and 55°N. They are farther north than the wheat and corn belt of the USA, in the central north-eastern and central north-western states (to the east of the Rocky Mountains)—approximately between 37° and 47°N. In area, the agricultural belt of the USSR is double that of the USA, but has less favourable climatic conditions. The rainfall in the Soviet Union's agricultural belt, for example, is roughly 35-65 centimetres a year, while in the USA it is 35-75 centimetres a year in wheat-growing regions, and 75-100 centimetres in corn-growing areas. The vegetation period in the USSR is shorter too. In spite of this, the USSR produces only slightly less grain than the USA, though the different crops are somewhat differently distributed. Two or three times more food grain crops are harvested in the USSR than in the USA, and only 30-50 per cent of America's output of fodder crops.

As agriculture developed, more and more agricultural land was put under the plough. In the Central Black-Earth region, more than 80 per cent of the land is tilled, 65-70 per cent in the Volga-Vyatka, Central and Volga regions, and 80 per cent in the Ukraine. In the 1950s and 1960s, about 10 million hectares of black earth and about 30 million hectares of dark chestnut, chestnut and other less fertile soils were ploughed up. This is an area equal to the whole sown area of a number of West European states taken together.[1] Since the Revolution, up to 70 million hectares in all have been ploughed up, permitting a significant increase in the sown area. It must be noted, however, that at the same time the area of pastureland and hayfields has fallen, particularly during the 1950s and 1960s.

The development of unused land for agricultural production was of great socio-economic significance. In the former

[1] See *The USSR in Figures*, Statistical Handbook, Moscow, 1958, p. 210 (in Russian).

thinly populated areas of Siberia and Kazakhstan, major agricultural enterprises were set up and equipped with advanced machinery. The sown area of Kazakhstan almost trebled, while that of Siberia increased by 50 per cent. Many residential and public buildings were, put up, and railways, roads, elevators, warehouses, electric power stations and enterprises to process agricultural produce were built. The population of these regions has risen.

The struggle against erosion plays an important role in preserving land in the USSR, for erosion is a very serious problem. In the USA, vast areas have been put out of use by erosion at a rate of about 300,000 hectares a year.[1] In the USSR, roughly 17 per cent of agricultural land, or 100 million hectares, including 50 million hectares of arable land, are affected by different types of erosion. Ravines alone occupy five million hectares. Water, wind and other types of erosion cause the deterioration or even destruction of the soil; the harvest falls by 20 to 40 per cent and the annual losses caused by erosion run to vast sums. Planted forest belts must be extended, as these provide good protection for the soil from dust storms and scorching winds.

The ploughing of large areas has a detrimental effect on the soil condition, particularly on lands that are sown with grain crops in unirrigated areas. With 60 to 70 per cent of the steppe-land ploughed up in these areas, dust storms become frequent. With 80 to 90 per cent ploughed up, dust storms strike more frequently, destroying the soil. Such things are happening not only in the USSR. On the other hand, in areas having large tracts of irrigated land, wind erosion and dust storms are rare.

Considerable harm is done to the land by infertile mine waste, open-cast mining, ash and slag dumped by electric power stations, and so on. In certain regions, open-cast mining of minerals is accompanied by destruction of agricultural land, such as the highly fertile lixiviated black earth in the area of the Kursk Magnetic Anomaly. It is essential that such soils be returned back to cultivation.

Between 1963 and 1971, 12 million hectares were taken away from collective and state farms for industrial, trans-

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[1] See *News of the USSR Academy of Sciences*, 1968, No. 9, p. 24 (in Russian).

port and urban construction.[1] Between 1961 and 1970, in the RSFSR alone, 5.6 million hectares were used for these purposes, including 2.5 million hectares of agricultural land, 1 million hectares of which were arable and irrigated. The loss of farm output from this was significant. Considerable areas, including flood-plains, are occupied by reservoirs.

In general, the loss of land over the last few decades owing to industrial, transport and urban construction and also through erosion, salination and land-slides, runs to dozens of millions of hectares. Still, the total area of arable land in the country has remained at the same level for the last 20 years and in 1975 was 226 million hectares. This is because of the major steps taken to plough up virgin and fallow lands, as mentioned above, and more economical and careful use of land. These steps were all the more necessary because, with the area of arable land remaining unchanged, the population growth had brought the area per head of the population from 1.2 hectares in 1954 to 0.89 hectare in 1976.

There is still enough land in the USSR for farming purdoses—the total agricultural area in the country, including ploughland, hay and pastures can be increased by roughly 10 per cent. Putting these lands into cultivation will require large capital investment: in some cases, on irrigation or drainage, while in others, on uprooting, cultivation and filling in ravines. This might cost between 500 and 20,000 rubles or more a hectare, with an average of about 2,000 rubles a hectare.

All the measures mentioned for improving land resources are designed to raise the productivity of agriculture and increase its output.

Fuller and more rational use of land resources is an important task. A national plan must be drawn up for land utilisation, and for this purpose a land register, already compiled in some Union Republics of the USSR, is required. Data on soil rating and comprehensive evaluation of the quality of individual plots of land give the planning authorities

[1] See N. V. Melnikov, "Rational Utilisation of Natural Resources", *Kommunist*, 1973, No. 15, pp. 83-84.

an idea of precisely what land resources the country has, where they are, how correctly they are being utilised, and to what extent they may be increased.

Along with improvement in the planning of land resources, stimulation of economical use is also of considerable significance.

In our opinion, one way of doing this is to set prices for the land. This does not mean, however, that land, which is state property in the USSR, would be put up for sale. Evaluation of land and its inclusion in the balance-sheet of the enterprise would have the same positive effect on its self-sufficiency as the inclusion of other fixed assets. At the same time, the evaluation of land would promote its more economical use in the designing and construction of enterprises. At the present time, with land being free of charge and other fixed assets subject to payment, only fixed assets are considered in planning and construction.

The land can be valued by dividing the differential rent over the efficiency norm: $S = \frac{R}{E_n}$, where R is the differential rent and E_n is the efficiency norm. The magnitude R must be correctly determined, without confusing it with the additional net income that might result from improved organisation of production, the elimination of losses or hold-ups, the application of advanced know-how, higher-quality work and improved marketing, i.e., that which does not depend on the properties of the land.

In order to evaluate a piece of land withdrawn for non-agricultural purposes, its qualities according to the register must be known and the quantity of output that it might yield under average conditions of social production must be determined. Then the outlays necessary to obtain the output from the next plot of inferior quality that will have to be exploited to produce the given output must be calculated. The difference in running costs can be used to obtain the initial value of the land, by dividing this difference over the efficiency norm for agriculture; capital investment necessary to ensure the given volume of production must be added to this value. On the other hand, account must also be taken of the effect that might be derived if

the land is withdrawn for non-agricultural purposes. This effect must also be divided over the efficiency norm. The algebraic sum of these three magnitudes (the third magnitude is subtracted) constitutes the value of the plot of land.

Various methods are used for evaluating land. According to S. D. Cheremushkin, D. Sc. (Econ.), who made his calculations at the USSR Research Institute of Agricultural Economics, the average value of a hectare of agricultural land in the USSR is 309 rubles. The land of the highest value is in Moldavia, with its vineyards and orchards, at 1,780 rubles; in Krasnodar Territory at 1,370 rubles, in the Kabardinian-Balkar Autonomous Republic at 730 rubles and in the North Caucasus at an average of 636 rubles. Land is valued at above average in the Central Black-Earth area, at 508 rubles, including 620 in Voronezh Region and 610 in Belgorod Region. The average value of land in Moscow Region is 570 rubles per hectare. The lowest values are in Kazakhstan, at 112 rubles, Yakutia at 110, Khabarovsk Territory at 120, the Tuva Autonomous Region at 60, Astrakhan Region at 130 and the Tomsk region at 140 rubles. These data are only suitable for general calculations, of course, and for practical purposes each plot of land must be evaluated separately.

According to calculations made at the Economics Institute of the USSR Academy of Sciences by a different method, the average value of a hectare of agricultural land is 358 rubles, in one case, and 268 rubles, in another. All these figures are perhaps overstatements. If one takes a value of 309 rubles a hectare, the value of agricultural land would be 187,000 million rubles, while the total value of productive fixed assets (minus land) on January 1, 1976, was 806000 million rubles, and including land it was 993,000 million rubles, the land accounting for somewhat about 19 per cent of this sum.[1]

Evaluation of the land should not, of course, be based on general estimates which only give an idea of the scale of the figures that are involved. Rather, the value of land

[1] In pre-revolutionary Russia in 1917, the land was evaluated at 44,000 million gold rubles. Taking the value of agricultural land as

must be calculated on the basis of a land register and comprehensive assessment of the quality of individual plots. The value of land that is to be irrigated or drained (approximately 50 million hectares), requiring investment of more than 100,000 million rubles in the next few decades, will rise further. Expenditure on irrigation and drainage of the land makes it possible to raise agricultural output substantially and make better use of land resources.

In many instances, the price of land calculated by the above method is not high enough to be an incentive to make better use of the land, particularly when it is withdrawn for non-agricultural purposes. For example, the construction of modern large-scale industrial enterprises, particularly in heavy industry, often costs dozens of millions of rubles. Even if the land on which the enterprise stands is valued at tens of thousands of rubles a hectare, it would still constitute only a very small part of the total capital investment.

Naturally, if the planners are faced with an alternative—to economise on the cost of the land or on construction and installation, the saving in the second instance would be greater than in the first and the second choice will seem preferable. This means that, either the price of the land must be raised sufficiently to make the saving on the cost of the plot of land more or less equal to that on construction and installation, or the decisive factor in such cases must be not the value of the land, but direct regulation by competent authorities of its allocation. The latter is the more correct and realistic way. The problem of thrifty use of the land must be tackled during designing and planning and be reflected in all the instructions and regulations for designers and planners.

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200 rubles a hectare, its total value would come to about 122,000 million rubles, or 16 per cent of the total value of fixed assets, including land, and 21 per cent of the total value of fixed productive assets, also including land. Taking the fixed productive assets in agriculture, including cattle, and adding the value of the land, the former increase by 130 per cent, 213,000 million rubles.

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4. FRESH WATER RESOURCES

River run-off belongs among replaceable natural resources and it is only as a result of abuse and pollution of rivers that water becomes unusable, as is happening in the developed countries of Europe and North America. Still, even when there is a significant degree of pollution of rivers and lakes, the original qualities of river water can be restored if the draining of untreated wastes ceases.

The rivers of the USSR have an enormous run-off of some 4,400 km^3 a year. Subterranean fresh water resources for half the territory of the USSR are estimated at 1,000 km^3 a year.

However, the run-off is unevenly distributed throughout the country. The biggest rivers—the Ob (plus its tributary the Irtysh), the Yenisei, Lena and the Amur, are all in Siberia and the Far East. The overall run-off of these areas is 3,100 km^3 a year, i.e., three-quarters of the total run-off. The European part of the USSR has an average run-off of 989 km^3 a year, the Urals, 101 km^3, Kazakhstan, 65 km^3, and Central Asia, 116 km^3. Many regions of the European part of the USSR—in the Centre, Donbas, the Southern Ukraine, the Crimea, Moldavia, the Lower Volga, the North Caucasus, Central Asia, Kazakhstan, the southern part of Western Siberia and the areas east of Lake Baikal—are short of water.

The water level in the Caspian Sea has dropped significantly, less and less fresh water is flowing into the Aral and Azov seas, and the salt content of the water is rising. All this has a detrimental effect on the fishing industry.

The considerable fluctuations in the run-off from year to year and season to season are also unfavourable. In dry regions, the volume of the annual river run-off in years with a low rainfall is only 3 to 4 per cent of the average over several years, while during periods of heavy rainfall it is 300 to 400 per cent of this level. During the spring and in some places the summer floods, 60 to 90 per cent of the annual run-off flows down the rivers in the course of two to three months, which often results in flooding, most of the water being drained into the seas.

The main consumers of water at the present time are

agriculture (about 150 km^3 a year), industry (about 75 km^3 a year), fisheries, cities and urban settlements.

A significant proportion of the water consumed is not recycled. In agriculture, irreplaceable losses account for 80 to 90 per cent of the water used. Industry returns 60 to 65 km^3 of polluted or badly purified water to the lakes and rivers every year, irreplaceable consumption and losses accounting for 10 to 15 km^3. Five to six cubic kilometres of sewage are discharged by towns and urban settlements. Moreover, a large quantity of water—1,000 km^3—passes through hydroelectric power station turbines, not counting the repeated use of the run-off by several hydro-electric power stations built on the same river, and is used for the development of fisheries.

In the future, the demand for fresh water will increase considerably, especially owing to the increase in the amount of water for irrigation. It has been calculated that irrigation of 40 million hectares will result in a very great water shortage in the river basins in the European part of the USSR—in the basins of the Volga, Dnieper, Don, Kuban and the Kura, and also in the rivers in the south of the Asian part of the USSR—the Ural, Amu Darya and Syr Darya. Irrigation of 30 million hectares will result in a smaller overall water shortage, but in certain basins, such as the Volga, Dnieper and Amu Darya, it remains very significant, where it will constitute 15-16 km^3, about 9 km^3 and 23-25 km^3, respectively. Serious measures are needed to deal with such water shortages. One of the most expensive is to divert water from other basins. Purification of sea water must also be used, as must various methods for thrifty water use.

The possibility of diverting water from the basins of the northern rivers of the European part of the USSR into the Volga and the Caspian Sea and also of diverting the Ob and Irtysh into Kazakhstan and Central Asia must be given careful consideration. The problem is not simply a technical one, though this is complex enough. The effect of diverting the water must be considered: on the regions to which it would flow, i.e., irrigation of the basins of the Volga and other rivers, an increase in the water level in these rivers and in the Caspian, improved fishing condi-

tions and so on; and on the regions from which the water is to be taken, i.e., the basins of the Pechora, Northern Dvina, Ob and Irtysh, so that the loss of water does not have a detrimental effect on these rivers. Thorough economic calculations are needed to resolve these problems.

An economic foundation is also necessary for working out measures to save water. These include reducing water losses during irrigation and drainage by lining canals, building gutters, drainage systems, regulating reservoirs and so on. These measures will help to prevent the seepage of water and rising of the sub-soil water level, which causes salination of large areas, and to reduce evaporation. The improvement of irrigation systems requires considerable capital investment, but would help to raise their efficiency which at the present time is extremely low, being only 0.5 (i.e., 50 per cent of the water is lost). In industry, a transition to recycled water supplies, repeated use of water, the substitution of "dry" for water-consuming production processes and cessation of the discharge of non-purified water are envisaged.

In accordance with the Principles for Water Legislation, the discharge of non-purified water and waste into rivers and water basins is prohibited, but this rule is often violated. In conjunction with administrative measures, economic measures such as the planning of water use and its economic evaluation, are also important for preserving pure water resources.

Calculating payment for water is considerably simpler than calculating that of minerals and land resources. Calculation should be founded on outlays made on drawing the water and delivering it to the consumer, and also on restoring irreplaceable water losses. These expenses include deductions from the value of engineering installations, expenditure on their maintenance and repair, and also on regulation of the sources of water supply and making up water losses. Water purification is a crucial issue. Purification must be paid for by the enterprises that use the water. If non-purified water is drained, the enterprise manager must be fined a sum sufficient to compensate for the damage done and, in particularly dangerous instances, the guilty parties must be prosecuted.

Economists have calculated that the average price of 1 m^3 of water delivered to the enterprise or removed from it is about 0.7 kopeck, while the total cost of water is about 3,000 million rubles a year.[1] This does not include payment for purification of polluted water. According to data adduced at the session of the Supreme Soviet of the USSR in September 1972, by the end of the 1970s 1,000 million rubles would be spent on water purification in cities situated in the basins of the Volga and the Ural, and by 1980, the drainage of non-purified or inadequately purified industrial waste and sewage into these basins would be halted completely. As far as the value of water in regulated and free major water drainages is concerned, it is considerably below the figures given above and, according to the same calculations, fluctuates from 0.1 kopeck (the Kuban and Moscow rivers) to 0.006 kopeck (the Yenisei and the Pechora). The price of fresh water from these rivers differs correspondingly, not counting, of course, direct expenditures on the delivery of water.

5. FORESTS

The USSR has the largest forest resources in the world. The total area of forest is 647 million hectares, i.e., a third of the country's territory and about 22 per cent of the forests of the world. The timber reserves in these forests amount to 80,000 million m^3, which exceeds the reserves of Canada, the USA, Sweden and Finland taken together. A major proportion of the forests in the Soviet Union are conifers—74 per cent, with hard-wood deciduous varieties making up 4 per cent and soft-wood deciduous varieties—22 per cent. The share of the Soviet Union in the world's reserves of coniferous forests is 62 per cent. By individual varieties, the first place belongs to the larch (35.7 per cent of all timber reserves), followed by the pine (19.2 per cent), the spruce (16.3 per cent) and the Siberian cedar (about 9 per cent). Common among the hard-wood deciduous varieties are the oak and the beech, while the main softwood is the birch.

[1] See *Intensification and Reserves in the Economy*, Moscow, 1970, p. 82 (in Russian).

These general figures show how great the forest wealth of the USSR really is. It would be an oversimplification, however, to suggest that this wealth can be preserved by reducing felling. In fact, however, in order to preserve it, the age, variety and location of the forest must be taken into account. The proportion of mature and overmature forests is high—about 62 per cent of the area and 72 per cent of volume. Trees in these areas must be felled and used as raw material for the timber industry. Overmature forests should also be selectively felled in order to ensure the development of younger stands—the raw material resources of the future. The country's forest wealth must, however, be made accessible and this necessitates development of the transportation network for taking the timber out of the forests.

The most valuable varieties of timber are the conifers, while among the hard-wood deciduous varieties, they are oak and beech which are used as building materials. At the modern level of technology, however, soft woods are also coming into increasing use, as are all sorts of timber waste available at felling sites and processing plants, to produce pulp and other products. This expansion of the range of processed timber materials considerably increases the opportunities for using forest resources and their significance for the country.

Most forest resources are situated in Eastern Siberia and the Far East, while most timber is felled in the European part of the USSR and in the Urals, where only 20 per cent of commercial forest reserves are located. An increase in the share of the eastern regions will necessitate greater expenditure on felling and transportation, but will result in more rational exploitation of the country's forests.

Many of the shortcomings in forest exploitation have not yet been eliminated. It is primarily the most valuable coniferous trees that are felled, which results in overfelling of the best varieties, with the low-value deciduous varieties remaining intact. Collective-farm forestry is often conducted unsatisfactorily.

Stricter control is, therefore, required over timber-felling organisations and over preservation of the soil covering, which is often destroyed by machinery. Improved trans-

portation of the timber and a halt to floating logs downstream, which obstruct the rivers and are harmful to fisheries, are also of considerable importance.

In recent years, the afforested area in the country as a whole has been increasing by 2-3 million hectares per annum, and in the European part of the USSR, by 0.5 million hectares, including the forest deficit zones. The timber processing methods are also improving, as a result of which the rate of logging has fallen significantly.

In the future, the afforested area will increase as more and more trees are planted by man. The area of the green belts around cities will increase, and forest reserves, national parks, and forest tourist zones will be created.

The forest resources, in contrast to other natural resources, are evaluated according to so-called payment on the stump, paid to the state by logging organisations. The size of "payment on the stump" must be sufficiently high to compensate the state for expenditure made on forest development, on maintaining the forests and restoring them. "Payment on the stump" should also be used in addition to planning measures to regulate the volume of timber felled.

6. THE RESOURCES OF THE SEAS AND OCEANS

The seas and oceans are an important source of food. The total fish resources of the seas and oceans are estimated at roughly 200 million tons. Fish catch is rising at a very rapid pace: from 7-8 million tons caught in the world in 1913 to 20 million tons in 1938, 28 million tons in 1955 and 66 million tons in 1973. The share of the Soviet Union is about 9 million tons. Apart from fish, whales and other sea animals are hunted.

Up to the present time, man has taken all the wealth from the seas and oceans without giving anything in return, although the productivity of the seas and oceans can be increased significantly by breeding the living creatures and plants in water. In the USSR and some other countries, experience has already been accumulated in breeding fish artificially (sturgeon and salmon), raising molluscs, oysters and shell-fish, of fertilising bays and

inland seas, transferring fish from one basin to another, and growing seaweed.

In 1969, the first sea fish farm of fish-ponds was set up in the Taganrog Bay on the Azov Sea to produce food-fish. Farms are being created by fishing collective farms. Fish output now averages 7,000 tons per hectare of fish-pond, and in some cases reaches 12,500 tons. Pacific salmon, the humpback or pink salmon, are being successfully transferred into the White and Barents seas, where they grow faster reaching greater weights than in the Pacific. These salmon are now being found around Norway and even along the British coast. Chum salmon and pink salmon from the seas of the Far East are being transferred into the Baltic. The USSR Ministry of Fisheries has 140 fisheries operating at a considerable profit. It has been calculated that one ruble invested in fish-breeding yields 30-rubles' worth of fish products.

Measures are being worked out to increase the productivity of the open seas. Simple measures such as limiting the catch in order to speed up the reproduction of schools or prevent the extermination of valuable breeds of fish and sea animals might also be economically effective. For this, international agreements and strict observance of these are required.

Economic calculations show that fish-breeding and cultivation can become extremely efficient. If fisheries are run rationally, more than a ton of fish can be produced per hectare of sea, while the normal productivity of the World Ocean—still at the "hunting" stage of development—does not exceed a ton per square kilometre.[1]

There are also rich deposits of various raw materials in the World Ocean. Common salt, magnesium and sodium sulphate (mirabilite) are obtained from sea water. Sea water is also an important source of potassium, bromine and iodine. Large quantities of gold, uranium, silver and a number of other elements are dissolved in the water. The USSR has the largest sea deposits of amber in the world. Sea water is a source of deuterium, essential for

[1] A comprehensive analysis of the possibilities for increasing the productivity of the World Ocean is contained in a book by S. V. Mikhailov, *The World Ocean and Mankind*, Moscow, 1969 (in Russian).

nuclear synthesis. The amount of deuterium in the water will provide mankind with energy for a virtually unlimited time.

The seabed conceals rich deposits of oil and gas. According to available data, the amount of oil in these deposits is 6-7 times greater than under land surface. Oil is extracted from the seabed in the USSR (in the Caspian), Britain and Norway (the North Sea) and the USA (California, Alaska and the Gulf of Mexico).

There are also considerable ore deposits in the seabed, including large accumulations of ferro-manganese concretions in the northern part of the Pacific Ocean and in the Baltic, the Barents and Kara seas. Some estimates put the concretion reserves in the Pacific at 100,000 million tons. The seabed also contains many other raw materials such as nickel, cobalt, phosphorite, etc.

Finally, the sea water itself is a source of fresh water. Sea water is freshened in coastal areas which have to bring fresh water from far away. It has been calculated that freshening sea water is efficient if fresh water has to be brought from a distance of over 150 km.

Finally, the sharp increase in pollution of the World Ocean in recent years must be mentioned. The main source of pollution is oil. As a result of the yearly increase in the transportation of oil and oil products, and also the use of liquid fuels in virtually all modern ocean-going vessels, millions of tons of oil and oil products are drained into the ocean each year during the washing of tankers and ship tanks, the discharge of wastes from oil-refining plants and oil depots, the leakage of oil during drilling and exploitation of submarine oil wells, and so on. Pollution of the seas causes the death of fish, sea birds and many other inhabitants of the ocean; it is harmful to fisheries, beaches and tourism.

In the USSR, effective measures are being taken to prevent sea pollution by introducing new systems for cleaning tankers, using floating cleansing stations, the construction of installations to catch water polluted by oil and trap oil, purification of waste water from oil-processing plants and so on. Experience shows that it is entirely feasible to reduce sharply the dumping of oil into the sea and, at the

same time, quickly cover costs by selling the oil collected. In the Soviet Union, the government has adopted resolutions on measures to prevent pollution of the Caspian Sea. These include measures to purify the water of the Caspian, prevent pollution by oil and oil products, unpurified industrial wastes and sewage and also ballast and overflow water from ships. To these ends, the national economic plans envisage necessary capital outlays.

7. THE ATMOSPHERE

As industry and transport, particularly road transport, have developed over the last few decades throughout the world, the atmosphere has become more and more polluted. In the USA, for example, more than 100 million tons of solid matter are exhausted into the atmosphere each year, including 60 per cent from transport, 19-20 per cent from industrial enterprises, 12-13 per cent from electric power stations, 6 per cent from heating systems and the rest from the burning of wastes. During the last twenty years, the amount of atmosphere pollutants has quadrupled and the damage they cause has increased sharply. Calculations show that at the end of the 1940s (in 1949), this damage was put at roughly 500 million dollars, while by the mid-1970s, it had reached thousands of millions of dollars.

The polluted air of major cities such as Los Angeles, Chicago and Washington, the transformation of Lake Erie and, to some extent, the other Great Lakes and rivers into dead water, soil erosion and frequent dust storms, and the millions of tons of garbage in large cities worsen living conditions, not infrequently causing premature death among the old and sick.

In the USSR, much is being done, with a considerable measure of success, to clean the air in large cities. Much time and money have yet to be taken to stop the exhaust of gases, smoke, ash and dust by electric power stations and industrial enterprises, and the draining of unpurified wastes, to make comprehensive use of raw materials, introduce waste-free processes, destroy or reprocess the garbage and sewage in large cities,

The amount of pollutants in the atmosphere is building up. Some of these substances are not distributed evenly, while many of them are dangerous even in small quantities. Cement dust covering the area surrounding cement plants has a detrimental effect on the environment. Electric power stations exhaust much ash into the atmosphere and cars exhaust carbon monoxide, etc.

There is an urgent need for measures to be taken to prevent further pollution of the atmosphere, including wide-scale use of improved methods for purifying exhaust gases, combustion of fuels that burn out more fully, and raising of the efficiency of power plants. It is important that internal combustion engines be replaced by electric motors.

Economic measures used to stimulate purification of the atmosphere envisage trapping the useful components of escape gases, introducing sanctions against the exhaust of pollutants, encouraging enterprises to take effective measures to prevent air pollution, and so on.

The task of introducing comprehensive planning of the use of natural resources raises the question of the feasibility of working out corresponding quotas on the basis of rational raw and other material requirements per unit of finished output.

The CPSU Central Committee and the USSR Council of Ministers have adopted a resolution "On Improving the Conservation of Nature and the Use of Natural Resources", which makes ministries and administrative bodies responsible for ensuring comprehensive, rational use of natural resources and the conservation of nature.

CHAPTER V

THE RESOURCES FOR ECONOMIC GROWTH. FIXED AND CIRCULATING ASSETS

1. THE BRANCH STRUCTURE OF FIXED AND CIRCULATING ASSETS AND ITS TRENDS

Another important factor in economic growth, apart from manpower and natural resources, is the fixed and circulating assets created by people's labour. These represent a considerable proportion of the national wealth and are the result of accumulation over a long period of time.

It is extremely important to increase the national wealth by creating new fixed and circulating assets, as a condition for economic growth in the near and the distant future. In the USSR, this process takes place according to a plan and is formed by the accumulation fund and depreciation allowances allocated out of the national income. The share of accumulation in the national income at the present time is about 25 per cent. The plan for centralised capital investment made out of the national income is based on requirements of the different branches of industry, republics and regions.

A major task of the planning bodies is to select the largest and most efficient construction projects, taking account of the need for the volume of capital investment to comply with realistic construction possibilities, on which the increase in the national wealth and the fastest possible acceptance of new fixed assets largely depend.

For economic growth, that part of the national wealth which is embodied in productive assets, i.e., means of production, including instruments and objects of labour, is of particular significance. The size and quality of these determine the productivity of labour and, consequently, the volume of production. The role of non-productive

assets, such as residential houses, public buildings and structures, municipal services, scientific and cultural establishments, etc. must not be underestimated either. An increase in these assets, which largely determines the rise in the population's standard of living, exerts an influence on the growth of labour productivity and on the development of production.

The total national wealth (excluding land and forests) constitutes, according to USSR Central Statistical Board estimates, 1,500,000 million rubles, twenty times more than before the October 1917 Revolution. Apart from fixed assets, this figure includes all other valuables created by the hands of the country's population. It must be stressed that this enormous growth in the national wealth was achieved in spite of the destruction wrought during the wars in which the Soviet people had to participate. The destruction wrought by the German invading forces between 1941 and 1945 constituted about 30 per cent of the national wealth, without taking account of the fact that the main productive force—the working people—was weakened by losses and diverted during the war from peaceful labour.

The rate of growth of the national wealth of the USSR is considerably higher than that of developed capitalist countries.

Table 10

Growth Trends of Fixed Assets (end of year)

	1928	1940	1950	1960	1970	1975
All fixed assets, including livestock	100	230	271	632	1,363	2,102
Productive assets	100	257	318	808	1,907	2,909
Non-productive assets	100	208	233	491	936	1,404

In comparison with 1928, fixed assets in the USSR had increased 21-fold by 1975. Productive assets had expanded particularly rapidly—29-fold. Non-productive assets had increased 14-fold.

Table 11

The Structure of Fixed Assets in the USSR

	Thous. million rubles			Percentage		
	Jan. 1, 1960	Jan. 1, 1970	Jan. 1, 1976*	1960	1970	1976
All fixed assets (including livestock)	297	860	1258	100.0	100.0	100.0
Productive fixed assets	174	531	806	58.6	61.8	64.1
including:						
industry	80	255	385	26.9	29.7	30.6
agriculture	42	106	168	14.1	12.3	13.4
transport and communications	39	117	172	13.1	13.6	13.6
construction	5	22	35	1.7	2.6	3.7
trade, public catering and supplies	8	31	46	2.7	3.6	3.7
Non-productive fixed assets	123	329	452	41.4	38.2	35.9
including:						
housing	95	204	267	32.0	23.7	21.3
municipal and domestic services	6	39	56	2.0	4.5	4.4
health service, education	22	48	76	7.4	5.6	6.0
science, art and other non-productive branches		38	53		4.4	4.2

* After the revaluation of fixed assets.

Fixed assets constitute more than half the national wealth. An inventory taken by the USSR Central Statistical Board in 1971-1972 puts the fixed assets of the USSR as of January 1, 1973 as having a replacement value of 1,003,000 million rubles (no allowance made for wear and tear), against 799,000 million rubles on January 1, 1972, or 25 per cent higher. The physical increase in fixed assets for the year was about 60,000 million rubles. The rest of the increase is accounted for by revaluation of the assets during inventory-taking. The replacement value of the fixed assets of self-financed state, co-operative and social organisations, and also of collective farms, as of January 1, 1972, was revalued at 721,500 million rubles, against 648,500 million on the balance-sheets of enterprises, or 73,000 million more. These changes are the result of a revaluation of a large proportion of fixed assets by 106,000 million rubles, and a devaluation of the remainder by 33,000 million.[1] On January 1, 1974, fixed assets reached 1,082,000 million rubles, and by the end of 1975, 1,258,000 million rubles, of which 806,000 million were productive fixed assets and 452,000 million non-productive.

Between 1960 and 1976, the share of productive fixed assets increased from 58.6 to 64.1 per cent. Of productive fixed assets, 385,000 million rubles is in industry. The revaluation somewhat reduced its share, but it was still higher than in 1960. After the revaluation, the share of agriculture increased somewhat, although it still fell short of the 1960 level. The share of transport remained roughly the same as in 1960. In non-productive fixed assets, the share of housing dropped considerably, while that of other non-productive assets is growing. The health service, education, science and art account for 110,000 million rubles of fixed assets, or 10 per cent of the total.

The structure of productive fixed assets by branches of the economy has changed since the Revolution as shown in Table 12 on the next page.

During Soviet times, the share of industry and construction has increased from 26.4 to 52.1 per cent in 1975, which

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[1] See *The National Economy of the USSR in 1972*, pp. 61-63 (in Russian).

Table 12

The Structure of Fixed Productive Assets

(*percentage of total*)

	1913*	1928*	1950**	1960**	1970***	1972***	1975***
All productive fixed assets	100.0	100.0	100.0	100.0	100.0	100.0	100.0
including:							
industry and construction	26.4	25.5	42.9	49.0	53.7	54.0	52.1
agriculture	36.4	37.4	26.8	24.2	19.8	19.6	20.8
transport and communications	36.4	34.8	26.1	22.5	20.4	20.2	21.3
trade, public catering, supplies and other	0.8	2.3	4.2	4.3	6.1	6.1	5.7

* Calculated from *The National Economy of the USSR in 1958*, p. 58 (in Russian).
** Calculated from *The National Economy of the USSR in 1960*, pp. 85-86 (in Russian).
*** *The National Economy of the USSR* for the corresponding years as of January 1 (in Russian).

reflects the industrialisation in the country. At the same time, the share of agriculture has fallen significantly, and so has the share of transport and communications.

The share of trade, public catering and supplies is on the increase, but is still at a low level.

A considerable part of the fixed assets in industry is concentrated in the key branches of heavy industry: in electricity generation, the fuel industry, iron-and-steel industry, the chemical and petro-chemical industries, engineering and metal-processing. These industries account for almost 70 per cent of all industrial productive fixed assets. Electricity generation and the fuel industry together have 29 per cent of industrial productive fixed assets, engineering and metal-processing have roughly 21 per cent,

the iron-and-steel industry has about 10 per cent and the chemical and petro-chemical industries have 9 per cent. In recent years, the shares of electricity generation, the chemical and petro-chemical industries, engineering and metal-processing, and to a small extent, of the building materials industry, have been increasing. In the future, the share of the industries, which are highly important for modernisation of the national economy, will rise.

Table 13

The Share of Industries in the Composition of Fixed Industrial Productive Assets

Industry	On January 1 (percentage of total)			
	1960	1970	1974	1976
All industries	100.0	100.0	100.0	100.0
Electric power	11.9	15.8	16.0	16.8
Fuel	17.0	13.5	12.7	12.6
Iron-and-steel	9.6	10.3	9.9	9.8
Chemical and petro-chemical	4.9	8.7	9.4	9.4
Engineering and metal-processing	20.3	19.7	21.0	21.5
Timber and wood-processing, pulp-and-paper	5.9	5.0	4.9	4.8
Building materials	5.3	6.2	6.1	5.7
Light	4.5	4.5	4.6	4.4
Food	9.1	8.6	8.3	7.9

About 12 per cent of fixed productive assets is concentrated in Group B (consumer goods) industries, and the share of the food industry is double that of light industry, to no little extent thanks to the large fishing fleet. The share of the food industry is gradually falling, while that of light industry increased somewhat in 1973. Further development of light industry and the installation of modern technology will raise its share even more.

The behaviour of fixed assets should not be described in prices as these are constantly rising, particularly in con-

struction and engineering and sometimes in other industries too. Industrial projects can be more or less expensive, require different quantities of building and other materials, with a higher or lower labour productivity. Figures reflecting the growth of fixed assets in physical terms are, therefore, also important. Data available on the productive capacities put into operation show how great the growth has been. In the 15 years from 1961 to 1975, 160 million kilowatts were added, or almost three-quarters of the capacity of electric power stations already in operation. In iron-ore mining, new plants capable of increasing output by 382 million tons a year were put into operation, and the new plants in the mineral-fertiliser industry produced an additional 94 million tons (in conventional units), which is more than the previous annual output. In the production of sulphuric acid, new plant increased output by 16.9 million tons, while the output in 1975 was 18.6 million tons. The figures for calcinated soda were 3.1 million and 4.7 million tons, respectively, and 722,000 and 955,000 tons for chemical fibres, 2,233,000 and 2,840,000 tons for plastics and synthetic resins, 13.2 million and 17.1 million kilowatts for turbines. A large part of output is, therefore, produced by new plant put into operation in the period 1961-1975. For other types of output, the share of plant commissioned during this period is smaller, but is still large. For example, the capacity of new plant in coal-mining is 289 million tons, with a yearly output of coal in 1975 of 701 million tons. The corresponding figures for steel smelting are 44.6 million and 141 million tons; 7.3 million and 16 million tons for steel pipes; 66.3 million and 122 million tons for cement; 336,000 and 550,000 for tractors, and so on.[1] Among consumer goods, the share of new machinery is very large in the production of TV sets, refrigerators, vacuum cleaners, washing machines and other consumer durables.

During the years of industrialisation leading up to the 1941-1945 war, capacity was increased primarily through the construction of new enterprises, including the Magnitogorsk, Nizhny Tagil, and the Kuznetsk iron-and-steel

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[1] See *The USSR in Figures in 1975*, pp. 157-58.

plants, the Kharkov and Stalingrad tractor works, and the Gorky and Moscow automobile plants. In the post-war years, capacities were raised on new plant installed in existing enterprises—in the iron-and-steel, engineering and other industries, although new ones were also built, such as the hydro-electric power stations of the Volga, in Bratsk, and Krasnoyarsk, the Konakovo and Nazarovo thermo-electric power stations, the car plant in Togliatti, chemical plants and others.

The creation of fixed productive assets on such a large and unprecedented scale was a precondition for the rapid development of the production of such traditional products as coal, metal and building materials, and of new products that did not exist before the war: computers, automatic transfer lines and machine-tools, various instruments and automatic machines, many chemical products, etc.

Non-productive construction, particularly of housing, has developed on a large scale since the war. During the Sixth, Seventh and Eighth Five-Year-Plan periods, 474, 491 and 519 million m^2 of living space were built, respectively, or 34.2 million flats, while during the Ninth Five-Year-Plan period, the corresponding figure was more than 545 million m^2, or about 11 million flats.[1] During the Tenth Five-Year-Plan period, 550 million m^2 will be built. The fact that in spite of the large scale of housing construction, the share of housing in fixed assets fell somewhat is due to the even higher growth rate of productive fixed assets.

Non-productive assets in education, science, culture and art also grew at an accelerated rate. Investments in these fields during the Seventh and Eighth Five-Year-Plan periods amounted to 36,500 million rubles and 26,186,000 million rubles between 1971 and 1975. The investment in education facilities during the 1960s meant that more than 25,000 schools of all grades were opened,[2] or, together with schools on the territory of collective farms, 49,000 for 16.7 million students. From 1966 to 1975, ten million m^2

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[1] See *The National Economy of the USSR in 1975*, p. 569.

[2] See *National Education, Science and Culture in the USSR*, Moscow, 1971, p. 387 (in Russian).

of premises for higher education institutions and specialised secondary schools were built. Capital investment in the construction of scientific research institutions exceeded 5,000 million rubles during the Seventh and Eighth Five-Year-Plan periods. A number of major research institutions were under construction throughout the country during these years. Full-scale construction of a science centre (named Akademgorodok) near Novosibirsk was completed, research centres were built in Eastern Siberia (Irkutsk), in the Far East (Vladivostok), and in a number of cities in the Ukraine, Byelorussia, the Baltic republics and Transcaucasia. The research institutes in Dubna, Pushchino and Serpukhov acquired added importance. The construction of scientific establishments was continued during the Ninth Five-Year-Plan period and capital investment in this sphere considerably exceeded that made during the previous five years.

In the field of culture and arts, 1,411 cinemas with 614,000 seats, 19,200 clubs and cultural centres with 4.6 million seats were built from 1966 to 1970.

All this testifies to a substantial growth in the material base of education, science, culture and arts, ensuring the realisation of one of the major goals of socialism—an increase in the people's cultural level.

Now let us turn to circulating assets. In 1975, the aggregate sum of these assets amounted to 314,000 million rubles, including 234,000 million in stocks of commodities and materials. This figure does not include the material circulating assets of collective farms, estimated at about 25,000 million rubles (indivisible funds). On the other hand, it does include the circulating assets of the trade network—57,000 million rubles. Adjustment puts the value of circulating productive assets at 202,000 million rubles in 1975 against 56,000 million rubles in 1960—an increase of 260 per cent. For comparison, let us note that fixed productive assets also increased by 259 per cent during this period. The share of circulating productive assets in all productive assets in 1975 was 25 per cent against 32 per cent in 1960. Taking the revalued figure for fixed productive assets—806,000 million rubles in 1975—the sum total of fixed and circulating assets in that year was 1,008,000 million rubles,

with the share of circulating assets dropping to 20.2 per cent.

Remembering that prices changed during these years, the ratios indicated above should only be taken as approximate. Calculating for the future, the point of departure should be the possibility of decreasing the material requirements per unit of output which might affect the share of circulating assets. On the other hand, the assets-output ratio will also fall, while with technological progress, fixed productive assets might become more complex and expensive, and the future ratio between fixed and circulating productive assets will depend on these changes.

The structure of circulating assets by sector of the economy has also changed. In 1975, 84,000 million rubles or 41 per cent of circulating assets belonged to industry (54 per cent in 1960), 51,000 million rubles or 25 per cent to agriculture (20 per cent in 1960), 32,000 million rubles or 16 per cent to construction (5 per cent in 1960), 24,000 million rubles or 11 per cent to supplies and sales (12 per cent in 1960).

From 1960 to 1975, material circulating assets in industry increased 190 per cent, while industrial output grew 225 per cent over the same period, which indicates an accelerated rate of turnover of industrial circulating assets. The share of circulating assets in industry in aggregate circulating productive assets of the economy also fell. The increase in the share of construction is the result of a transition to financing only completely finished projects, which leads to a growth in the circulating assets of construction organisations.

2. THE TECHNOLOGICAL STRUCTURE OF FIXED ASSETS AND THEIR RENEWAL

The technological structure of fixed assets is also changing. According to inventories of fixed assets for 1960 and 1972 (as of January 1), the share of buildings, structures and transmission gear increased between these years somewhat less than all fixed assets, while that of power and particularly working machinery, and also of measuring and adjusting instruments and gear, together with

Table 14

The Technological Structure of the Fixed Assets of Self-Financing Enterprises and Organisationes [1]

	1960	1972	Growth in per cent	Total assets in industry, 1975, in per cent
	Total balance value of fixed assets after revaluation : replacement value (in thous. mil. rubles)			
Total	200.1	721.5	260	100.0
Buildings	89.7	320.5	257	29.3
including housing	....	136.8	....	
Structures	53.8	119.3	122	19.6
Transmission gear	....	53.1	....	11.5
Machinery	....	147.2	....	
including:				
power machinery	8.3	31.9	284	8.0
working machinery	26.0	103.3	297	26.8
measuring and adjusting instruments and gear and laboratory equipment	1.4	6.9	393	1.2
computers	....	1.9	....	
other machinery	....	3.2	....	
Transport facilities	15.1	54.5	261	2.1
Instruments and tools	1.9	6.4	237	1.5

1 See **The National Economy of the USSR in 1960**, Statistical Yearbook, Moscow, 1960, p. 88 (in Russian). The value of all fixed assets was 296,500 million rubles. The value of all fixed assets at present-day prices after the revaluation was 924,000 million rubles on January 1, 1972, 1,003,000 million rubles on January 1, 1973, and 1,258,000 million rubles on January 1, 1976. Total assets in industry in 1975 constituted 806,000 million rubles. See **The National Economy of the USSR in 1973**, p. 57 and the same Yearbook for 1975, pp. 58 and 220.

laboratory equipment, increased to a substantially greater degree. These changes comply with the requirements of technological progress, the introduction of increasingly more complex machines and equipment, automatic gear and computers (see Table 14).

Overall, buildings and structures constitute half the value of fixed productive assets in industry, while the share of machinery, equipment and instruments is somewhat more than a third. The share of transmission gear is 12 per cent.

The technological structure of fixed assets differs according to industry. The share of buildings, for example, is particularly great in engineering and light industry (from 42 to 46 per cent), while in the oil-extracting, and fishing industries, it is only between 3 and 8 per cent. Structures account for 54 per cent in the fuel industry (about 70 per cent in oil extraction), 5 per cent in light industry and less than 9 per cent in engineering. The first place in power machinery is held by electric power stations (32.2 per cent), and in working machinery and equipment by light industry (40 per cent), followed by engineering (36 per cent). The share of means of transportation is particularly great in the fishing industry, with its large fishing fleet (79 per cent), and in the timber industry (more than 11 per cent).

There are differences between the components of fixed assets in their relationship to the production process. Components such as buildings, and partially structures, and roads, are conditions for the production process, make this process possible and act, as it were, as "passive" instruments of labour. Other components, primarily power and working machinery, participate directly in the production process and play an "active" role in it. For production to function normally, both types of instruments of labour are needed, but to different degrees. During the Second World War, the equipment of evacuated plants was sometimes set up at first in unsuitable premises, or even in the open, and production was begun in the absence of "passive" instruments of labour. Without "active" ones, however, this would have been impossible.

In order to improve the technological structure, when new enterprises are built and old ones modernised, measures are taken to make better use of production buildings and structures. For example, when deciding the distance between the supporting columns in large workshops, the designers must not forget that equipment must inevitably be changed periodically.

It might be efficient to put several workshops in a single building and to arrange them along the flow line so that factory handling could be more efficient. In a number of instances, it is possible for several related enterprises in a vicinity to make joint use of service shops. The cost of construction must be reduced by using modern components and cheap materials. An increase in the capacity of equipment may have a considerable effect by reducing the share of capital investment (in equipment) per unit of output.

Along with the quantitative growth of assets, qualitative changes due to the application of advanced machines are also of prime importance. Technological progress in the instruments of labour used is directed at raising the economic efficiency of production. It pays to install new machinery, therefore, when it helps to raise the productivity of labour, reduce material and labour expenditure per unit of output and, in the final analysis, to speed up the rate of economic growth.

The technical level of production rises as a result not only of the introduction of new machines, but also of obsolete ones being written off. The average service life of equipment depends on the ratio of new technology to the obsolete one. Unfortunately, in some industries, the actual period of service exceeds considerably the normal period. Obsolete equipment often necessitates expenditure on major repairs that exceeds the replacement value of the equipment. The productivity of labour on such equipment is sometimes much lower than on new equipment.

All this testifies to the need to speed up the development of engineering considerably, in order that old equipment might be replaced by new and the average service life of equipment throughout industry be reduced to nine or ten years. Engineering is faced with the task of supplying all industries with highly efficient machinery.

In recent years, the introduction of new fixed assets in the USSR has considerably outstripped withdrawals (see Table 15).

By the end of 1975, fixed industrial productive assets introduced during the period of the Ninth Five-Year Plan reached 40 per cent.

Table 15

Industrial Productive Fixed Assets as Percentage of Available Assets

	Introduced before 1961-65 as per cent of assets on Jan. 1, 1966	Introduced by 1966-70 as per cent of assets on Jan. 1, 1971	Introduced in 1971-75 as per cent of assets on Jan. 1, 1974
All industry	46	43	26
Electricity generation	34	35	20
Fuel	38	40	27
Iron-and-steel industry	43	39	23
Chemical and petro-chemical industry	58	51	29
Engineering and metal-processing	46	43	32
Timber, wood-processing, pulp-and-paper	52	48	30
Building materials	38	39	25
Light industry	39	43	28
Food industry	41	37	22

The technical level of production is rising more rapidly in progressive industries such as the power industry, instrument-making, the chemical and petro-chemical industries, but in many industries is still inadequate. There are still some enterprises in which auxiliary shops and services are not sufficiently developed. Although capital investment in these shops does not at first glance raise the output of the enterprise directly, if they are underdeveloped, bottle-necks might arise and slow down production.

In evaluating the growth of fixed productive assets in the long run, account must be taken of the need to withdraw more assets in order to renew them. Their withdrawal must be compensated for by the introduction of new assets, so that the latter might increase at a fast rate. At the same time, however, an intensification will take place in the use of assets and the technical level will rise, making in the future the intended growth rate of production possible at a low rate of growth in assets.

CHAPTER VI

THE RISING MATERIAL AND CULTURAL LEVEL OF THE POPULATION

1. REQUIREMENTS AND THE GROWTH OF INCOMES

The growth in the population's material and cultural level is one of the main factors in the development of the socialist economy. The higher this level is, the greater are scientific and technological achievements, the higher the rate of technological progress and the productivity of social labour. The increase in the material and cultural level of the people is not a passive result of the development of productive forces but an important condition for the active interaction of the resources for economic growth and their use by the working people. This increase is achieved as socialist production relations are perfected and develop into communist relations.

The goals of socialism are all-round satisfaction of the needs of society and an increase in its welfare. One way of satisfying these needs is to develop production, which gives rise to more and more new demands. On the other hand, the growth of demand stimulates production. Marxism-Leninism teaches that production is the determining factor in the relationship between production and consumption, as it is a condition for the existence of society and the source of its development. Soviet economic science has made a considerable contribution to the study of the laws governing the development of production, but society's demands, their structure and trends have not yet been studied to any great extent. Such a study is one of the major tasks facing economic science.

Needs can be divided into personal and social. Man's personal needs include material goods: food, clothing, fur-

niture, recreational and household appliances and housing. Then follow personal requirements for services—municipal, transport and trade. Then comes the need to improve one's knowledge and experience, including the need for education, the acquisition of production skills and raising of the cultural level. Also included among personal needs are physical exercises, sports, tourism, leisure and entertainment.

Social needs are subdivided into production and non-production needs. The former include whatever is essential for developing production, i.e., instruments and objects of labour, and manpower. The latter include the need for public catering, transport facilities, municipal services, the health service, and social insurance, education, science and culture. In contrast to personal needs, this implies public institutions to satisfy all these needs of society as a whole and, at the same time, of each of its members individually. Society's need for economic management, administrative management, and also for ensuring internal and external security, must also be singled out. This brief enumeration of needs is not exhaustive, and is only intended to give a general picture.

A study of these needs is very important for socio-economic planning and a thorough study makes it possible to arrange needs in order of priority. Some economic theoreticians consider this impossible and the very concept incorrect. We do not share their views, however. Planning, economic and production bodies are constantly having to arrange demands in order of priority, compare them, give preference to one or another; but this is frequently done at will, without due scientific substantiation, and understandably with a considerable margin of error. The structure of needs to be satisfied takes shape gradually, as a consequence of the trends in production and consumption, and those in incomes and the demands of the population, and on the basis of research into the relations between the needs and the possibilities for satisfying them. Theoretical and methodological principles must be worked out for comparing needs, although these will have nothing in common, of course, with the subjective methods of the theory of marginal utility. Rather the needs of society and

of its members must be objectively studied, the significance of satisfying these needs for social development assessed, and the needs compared taking account of efficiency and expenditure. Priorities in satisfying needs will change as productive forces develop. At the initial stages of development, personal needs, particularly those for food, clothing and housing, have the priority. At higher stages of development, new, more refined personal and social demands emerge.

Under capitalism, all means of production of unprecedented capacity—plants, factories, transportation facilities—acquire a social nature, while their appropriation remains private.

Social needs acquire a qualitatively new role under socialism, with the establishment of the complete dominion of socialist ownership of the means of production, when maximal satisfaction of these needs becomes the goal of production and rising demands become the rule. This process also embraces the sphere of personal needs. The demand for knowledge, skill and culture becomes increasingly important and the need for socio-political, party and state activity appears and grows stronger.

Needs change over time in response to various factors. The factors influencing the size of material needs include, above all, the growth of production, which makes more and more new products available and gives rise to a demand for them.

Another factor affecting the growth of material needs is the increase in knowledge and culture, which are themselves needs. A higher educational and cultural level and a wider range of interests engender the need for many articles and services which were not previously required.

A condition for the satisfaction of both material and cultural needs is a growth of incomes resulting from a rise in the productivity of labour and production growth. Incomes create purchasing power and, at the same time, the possibility of satisfying demands. The size of incomes and the population's demands must, of course, correspond to the development of the production of consumer goods and services, when incomes and expenditures are bal-

anced. The aggregate indicator of the growth of incomes is the national income.

The national income of the USSR during the Eighth Five-Year-Plan period increased at an average rate of 7.2 per cent per annum. During the Ninth Five-Year-Plan period, the average annual growth of the national income was 5.7 per cent. In 1975, the national income (in constant prices) was 32 per cent higher than in 1970. The per capita national income in 1975 was 1,423 rubles, i.e., had more than doubled since 1960.

Of the 362,400 million rubles of used national income in 1975, the share of personal consumption was 64 per cent, or 231,800 million rubles, which constitutes 911 rubles a year, or 76 rubles per month per head of the population (in 1960, the figures were 433 and 36 rubles, respectively).

The average monthly earnings of all factory and office workers increased by 80 per cent between 1960 and 1975 and stood at an average of 146 rubles in 1975, and 161 rubles for workers in industry. In 1975, the population received allowances and subsidies out of the social consumption fund equal to 90,100 million rubles, or 354 rubles per head (29.5 rubles a month). This includes free education and job training, medical care, pensions, allowances and grants to students, free and subsidised stays in sanatoria, holiday homes and tourist centres, paid holidays, and house maintenance not covered by rents. A significant proportion of these allowances and subsidies are received by factory and office workers, whose average monthly earnings, including allowances and subsidies paid out of the social consumption fund, amounted to 198 rubles (220 for industry workers) in 1975, as against 108 rubles in 1960. In this way, the social consumption fund raises the average earnings of factory and office workers by 35 per cent. The average monthly earnings per family of factory or office workers, including these allowances and subsidies, is 357 rubles (counting the wages of all working members of the family).

The incomes of collective-farm workers are somewhat lower than those of factory and office workers. However, the growth rate of their incomes is higher than that of the incomes of factory and office workers, and in recent years

has been roughly 50 to 70 per cent higher. This is why the gap between income levels is closing.

Special mention should be made of one more category of incomes included in the social consumption fund—pensions. The sum total of pensions paid out has increased from 7,100 million rubles in 1960 to 24,500 million rubles in 1975, an increase of 190 per cent.

The population's real incomes, including all incomes and allowances and subsidies paid out of the social consumption fund, adjusted for price changes, were 96 per cent higher per capita in 1975 than in 1960. The mean annual increase in real incomes during the Seventh Five-Year-Plan period was 3.6 per cent and 6 per cent during the next five years. During the Ninth Five-Year-Plan period, real per capita incomes rose 24 per cent, of which the earnings of factory and office workers rose on average by 20 per cent and those of collective-farm workers by 25 per cent.

From 1971 to 1975, the minimum earnings of factory and office workers were raised to 70 rubles and the wages of some categories of workers in the health service and education and of industrial workers in the North, the Urals, Siberia, the Far East, Kazakhstan and Central Asia were also raised. Taxes are no longer deducted from incomes below 70 rubles a month, and those on incomes of up to 90 rubles were reduced.

During the Tenth Five-Year-Plan period, the earnings of factory and office workers will rise by 17 per cent and, by the end of the fifth year, will average no less than 170 rubles a month. The incomes of collective-farm workers from work for the farm will grow on average by 26 per cent. The scale of these increases will be in keeping with the growth in the productivity of labour and with the necessary balance between accumulation and consumption in the national income. It is not difficult to work out what the increase in the population's incomes will be, if they grow at the same rate every five years as they did during the Ninth Five-Year Plan, i.e., at 30 per cent. Since labour productivity, and output too, increases at an even faster rate, the working people are able to satisfy their constantly growing demands more fully. The growth of the communist consciousness of the Soviet people will

keep these demands within reasonable bounds, while a very high level of material welfare and culture will be achieved.

2. THE GROWING CONSUMPTION OF MATERIAL GOODS

Not only rising incomes are needed for an increase in consumption, but also a greater output of goods entering the consumption sphere. With the 96 per cent rise in real incomes between 1960 and 1975 industrial output increased over the same period by 225 per cent, the production of consumer goods (Group B) by 178 per cent and average agricultural output (1971-75 to 1956-60) by 54 per cent.

When incomes rise, consumption not only grows, but also changes its composition. The least elastic are expenditure on and consumption of foodstuffs. This is the most essential part of consumption, the first priority. With a rise in incomes, this category changes only very slightly and its share, therefore, decreases, while with a fall in incomes, it is the last to be cut.

A sample survey of 62,000 family budgets showed that the share of the social consumption fund in incomes of industrial workers' families rose from 14.5 per cent in 1940, to 20 per cent in 1960, and 22.5 per cent in 1975. The share of foodstuffs in spending fell from 53.8 per cent in 1940 to 32.9 per cent in 1975. The share of spending on clothing and footwear falls less steadily, while that of spending on furniture and domestic appliances is increasing, although it is still not large (6.5 per cent in 1975). The share of expenditure on education, medical and other free services supplied out of the social consumption fund is constantly rising (to 14 per cent in 1975). The small share of housing expenditure (2.5 per cent) is remarkable: rents in the Soviet Union are among the lowest in the world. Accumulations are growing (from 2.9 per cent in 1960 to 6.8 per cent in 1975), which means both an increase in incomes and deferred demand.

Similar changes are taking place in the income and expenditure structure of collective-farm workers. The income structure of collective-farm families is changing as a result

of an increase in the share of incomes coming from the collective farm and payments from social funds, and also of a drop in the share of incomes from private plots (from 48.3 per cent in 1940 to 25.4 per cent in 1975), which is still high. The share of foodstuffs in family spending is falling (37.1 per cent in 1975), while that of money spent on fabrics, clothing and footwear (15.7 per cent), furniture and cultural and home items (to 5.9 per cent) is rising significantly, as is that on social services (21.1 per cent, met mainly out of the social consumption fund).

With the overall drop in the share of expenditure on foodstuffs in the budgets of both factory and collective-farm workers, positive qualitative changes are also taking place in its structure.

During Soviet times, the per capita consumption of a number of foodstuffs has risen in comparison with 1913: for milk and milk products it has doubled, to 315 kg in 1975 against 246 kg in the USA; for eggs it has trebled, to 215 against 277 in the USA; for sugar, increased by almost 400 per cent, to 41 kg against 45 kg in the USA, and for fruit it has more than trebled. At the same time, the consumption of potatoes and grain is falling sharply. However, comparison with scientifically established dietary norms shows that there must be a significant increase in the consumption of animal proteins, primarily of meat and lard (in 1975, the per capita consumption in the USSR was 57 kg against 118 kg in the USA, 75 kg in Britain and 81 kg in the German Democratic Republic). The consumption of milk, eggs, vegetable oils, fruit and berries must also be increased.

The structure and volume of consumption of foodstuffs in workers' families in large industrial centres (Moscow, Leningrad, Kharkov, the Donbas, and the Gorky, Sverdlovsk and Ivanovo regions) are at the present time considerably better than the average for the USSR and for the majority of items exceed the levels of developed capitalist countries. For peasant families in a number of regions (Vologda, Ryazan, Tambov, Voronezh and Orel regions), the food consumption indices fall somewhat behind the levels of these countries, while for individual items they are ahead (more milk and milk products are consumed

than average in the USA, more eggs and vegetables than average in Britain, as much sugar as in Britain, and so on).

Between 1922 and 1975, the structure of food consumption in the families of both factory and collective-farm workers changed considerably. In 1922, the main food items were grain products and potatoes, while there has now been a sharp increase in the consumption of the more nutricious foods such as meat, milk, sugar, eggs and fruit, and that of potatoes and grain products has fallen. In peasant families this is a comparatively slow process, while in workers' families it is more rapid. Even so, the consumption of grain products and potatoes still remains considerably higher than in the USA and Britain. The structure and volume of food consumption in factory and collective-farm worker families will continue to change in the same direction: the consumption of meat, eggs, milk, fish, vegetables and fruit will continue to rise and that of the less nutricious products will fall.

Since the Revolution, there has been a considerable increase in the consumption of non-durable consumer goods (such as fabrics, footwear and paper). For some types of consumer goods, the USSR has already overtaken or caught up with the volume of consumption in the most developed capitalist countries. In 1975, for example, 22 m^2 of cotton fabrics were consumed per capita in the USSR, 24 m^2 in the USA, 14.9 m^2 in Britain, and 16.3 m^2 in West Germany. For woollen fabrics the figures are respectively 2.8, 0.6, 3.1 and 2.9 m^2, and so on. In 1975, 3.2 pairs of leather shoes were consumed per head of the population in the USSR, i.e., close to the US level of 3.8 and the British level of 4.4.

Considerable shifts have taken place in the consumption of consumer durables (for domestic use). The majority of these goods only appeared after the Second World War, but the degree of demand saturation is already high.

The consumption of many durables has risen sharply. In 1975, 74 per cent of families owned TV sets, 61 per cent had refrigerators and 65 per cent washing machines. In developed capitalist countries, the degree of demand saturation for these articles is higher than in the USSR. In the USA, for example, on average 100 per cent of families have

refrigerators, 94 per cent washing machines and 94 per cent vacuum cleaners. There are 170 TV sets, including 80 colour sets, and 562 radios for every hundred families. The figures for European countries are somewhat lower. In Britain, for example, in 1972,62 per cent of families had refrigerators, 66 per cent washing machines and 85 per cent vacuum cleaners; the figures for France were 83 per cent, 60 per cent and 55 per cent, respectively; for West Germany they were 85 per cent, 61 and 82 per cent (in 1971), and for Japan, 84, 88 and 62 per cent. The production of these articles has been growing very rapidly in the Soviet Union in recent years, and in this the USSR has outstripped the majority of developed capitalist countries.

The USSR is in second or third place in the world in the production of washing machines, TV sets, radios, watches, refrigerators and many other consumer durables. Lately the production of these items has increased significantly and will be much higher at the end of the Tenth Five-Year-Plan period.

The USSR does not yet produce enough motor vehicles—less than the USA, Japan, Britain, France, West Germany and Italy. During the Ninth Five-Year-Plan period, the output of motor vehicles rose considerably and in 1975, more than two million were produced, including more than 50 per cent motor cars (in 1970, only 37.5 per cent were motor cars).

To assess the growth in the consumption of material goods in the future, different forecasting methods can be used: extrapolation, analogy and quotas. Extrapolation must not be simply a calculation of consumption in the future on the basis of current trends: it requires assessment of whether it is realistic to extend present rates into the future and to make adjustments to account for the possibility of a growth in production, labour productivity and incomes. The analogy method consists in comparing the volume and rate of growth of consumption in the USSR with those of other countries, taking account of the different development conditions. The quota method is based on calculation of future consumption from reasonable quotas for satisfying demand, taking account of incomes rising in the future. Analysis can also be made of consumption

of different items on the basis of data on actual consumption at different income levels. Assuming the change in the average income level, it is possible to predict the possible change in the structure and volume of consumption for the new average group of incomes (see Table 16). The data show that, with the transition from low to higher income groups, the consumption of foodstuffs grows most slowly, for it has a definite physiological limit. At the same time, changes take place in the kind of foodstuffs consumed, in favour of those of better quality, while the consumption of foodstuffs of inferior quality decreases. Consumer goods consumption grows considerably faster than that of foodstuffs, and the consumption of durables increases particularly rapidly.

The two lower groups are typical—up to 600 rubles and from 601 to 900 rubles, where the average income per member of the family is at present 770 rubles a year. In the future, the next two groups will evidently become typical—from 901 to 1,200 rubles and from 1,201 to 1,500 rubles. On the basis of the volume of consumption of these two groups, general calculations can be made of future consumption.

These are only approximate data for illustrative purposes, to show a possible method of calculation. In order to make use of them, more extensive information would be needed on individual income groups and articles consumed. In our opinion, the volume of consumption in the future might be two to three times greater, particularly with the systematic price reductions.

The trends in the consumption of all goods can be characterised by data on retail turnover, which in 1940 constituted 20,400 million rubles, 82,300 million rubles in 1960, and 215,400 million rubles in 1975.

In comparison with 1940, retail turnover in 1975 had increased more than eight times, with a particularly great rise in the turnover of non-foodstuffs: clothing and underwear 11 times, knitwear 26 times, footwear 11 times, furniture and carpets 27 times, crockery 12 times, radios 149 times, and so on. For individual items, in 1975 clothing and underwear accounted for 18,300 million rubles, knitwear for 10,000 million, footwear for 10,000 million, furniture and carpets

Table 16

The Average Annual Consumption of Certain Major Products by the Families of Factory and Office Workers with Varying Annual Incomes per Member of the Family[1]

Groups of families by annual income per member of family	Share of group in total number of factory and office workers	Baked products, kg	Meat and meat products, kg	Milk and milk products, kg	Sugar and confectionery, kg	Eggs	Fish and fish products, kg	Fabrics and clothing, rubles	Footwear, rubles	Furniture and household goods, rubles	Articles for cultural needs and recreation, rubles
Up to 600 rubles	14	144	40	250	34	116	11	62	19	18	19
601-900 rubles	37	130	58	320	38	170	15	104	31	34	34
901-1,200 "	29	124	75	340	43	230	18	150	44	53	50
1,201-1,500 "	17	118	88	400	48	290	23	186	50	74	66
More than 1,500 rubles	6	110	96	420	50	300	25	232	61	101	88

[1] Model according to I. I. Korzhenevsky's data. See *Major Patterns of Development of Demand in the USSR*, Moscow, 1971, p. 134 et seq. (in Russian).

for 5,400 million, and cultural items for 10,000 million, in all 50,000 million rubles. Non-foodstuffs account for 97,660 million rubles of the total retail turnover.

In the USSR, a leading place among foodstuffs is held by meat and meat products, fats, milk and milk products and eggs (31,946 million rubles in 1975) and also sugar and confectionery (13,700 million rubles), i.e., 45,646 million out of 112,729 million rubles of the total turnover of foodstuffs.

The significant increase in inventories within the retail network is also remarkable—from 1,600 million rubles or 9.3 per cent in 1940 to 45,420 million rubles or 21 per cent of all commodity turnover in 1975. In one sense, this is a positive fact, signifying the elimination of goods shortages, but it is also negative if the increasing inventories are the result of poor quality goods, obsolescence and the like.

Unsatisfied demand leads to money being put aside and a growth of savings-bank deposits, which in 1940 amounted to 700 million rubles, 1,900 million in 1950, 10,900 million in 1960, 46,600 million in 1970 and 90,985 million in 1975. The considerable increase in deposits testifies not only to increasing deferred demand, but also to a rise in the people's incomes and a growth of accumulations.

Some economists overestimate the role of commodity-money relations under socialism and suggest that the lack of balance between the growth of incomes and that of the amount of commodities available can be corrected by raising prices. This view is incorrect. The shortage of commodities must not be compensated for by higher prices. Prices can and must, of course, be regulated and can sometimes be raised, but only for a narrow group of articles such as cars, furs and jewellery, and in a number of instances for high-quality goods not included among the staple consumer goods. A price rise should not result in a drop in the level of consumption of the broad sections of the population and can only be used to achieve the temporary goal of redistributing accumulations from the higher paid groups of the population.

The main task is to increase commodity turnover somewhat faster than the incomes of the population, taking

into account which articles are in short supply and how to achieve balance between supply and demand.

To this end, the socialist state devotes particular attention to speeding up the production of consumer goods—durables and non-durables, especially high-quality goods, and also of foodstuffs. The industrial output of Group B (consumer goods) increased by 170 per cent between 1951 and 1960, 100 per cent between 1961 and 1970 and 49 per cent between 1971 and 1975. With the rate of increase in incomes planned in the future, the production of consumer goods must rise even more rapidly.

It must be remembered that considerably more workers are employed in Group A of social production than in Group B, which produces consumer goods. This can be judged from the number of industrial workers in Group A (i.e., not including the light and food industries), which employs three-quarters of all the factory and office workers in industry. Those employed in the production of agricultural raw materials, in the construction of production premises and structures, in freight transport and in the non-productive sphere must be added to this. This means that the total demand for consumer goods on the part of those employed in Group A and in the non-productive sphere grows significantly along with the increase in their share. So, in order to provide enough goods to satisfy the growing demand, not only the relative, but also the absolute increase must be taken into account and a rise in the production of Group B and in labour productivity must be envisaged that will ensure this increase. Account must also be taken of these proportions when determining the numbers employed in Group A industries and in the non-productive sphere.

Part of the population's demand for consumer goods, just as of the demand for means of production, can be met through foreign trade.

One of the population's major needs is housing. A great achievement of the socialist system is that it has solved the housing problem, is carrying out extensive housing construction at the state's expense and supplies the population with housing, without requiring any moving-in payment.

From 1950 to 1975, the state built about 51.4 million flats with a total living area of 2,270 million m^2. During these

years, about 200 million people, or 77 per cent of the population, moved into new homes. As a result, the living area in the towns per inhabitant increased from 6.3 m^2 in 1913, and 6.5 m^2 in 1940 to 7.4 m^2 in 1950, 9.2 m^2 in 1960, 11.0 m^2 in 1970 and 11.9 m^2 in 1975. In the future, housing construction will be stepped up considerably. If as much housing is built every five years as was built between 1971 and 1975, during the next three five-year-plan periods the total living area can be increased by about 1,700 million m^2 (not counting withdrawals). Then the per capita area will have increased by about 50 per cent. Along with the quantitative growth in housing construction, quality improvement is also extremely important, as is the provision of more amenities, light, air, and so on.

The increase in living standards in the future will make it possible to increase the proportion of co-operative housing construction, which will also have a favourable effect on the correlation between the population's growing money incomes and the supply of goods and services.

The increase in the population's living standards depends largely on social non-productive fixed assets. These include municipal services (water supply, sewage and urban transport), public buildings (administrative, scientific and educational establishments), museums, theatres, hospitals, sanatoria, shops, and so on. These assets must be considerably increased to make them correspond to requirements.

Public transport in the cities has developed rapidly. From 1960 to 1975 the length of trolley-bus lines and the number of trolley-buses more than trebled, that of buses quadrupled and the length of underground lines (now in six cities) almost trebled.[1]

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[1] See *The National Economy of the USSR in 1973*, p. 526; *The USSR in Figures in 1973*, p. 136.

In the capitalist countries, particularly the USA, urban public transport plays a minor role. Transportation by car has been developed beyond the bounds of reason, with unfavourable consequences. The motor vehicle is the main air polluter. It requires much fuel, particularly per passenger, and petrol supplies are becoming increasingly short. The car is also uneconomical: the cost of transporting passengers, particularly in large American cars of 250 to 300 h.p. or more, is extremely high. The following statistics show the advantages of public

The rapid development of urban public transport is one of the advantages of the Soviet Union but, in spite of this, the population's demand for transportation is not yet fully satisfied, the traffic does not run sufficiently frequently or regularly, and the transport system is greatly overstrained, especially during rush hours.

Municipal services have been developed considerably in the country. During the Eighth Five-Year-Plan period, 27,000 kilometres of water-supply lines were laid with a capacity of 12.5 million m^3 of water a day, about 10,000 km of sewer capable of handling 9 million m^3 of sewage a day, about 20,000 km of gas pipe-lines and 4,500 km of heating pipe-lines. Between 1960 and 1975, the number of flats with a gas supply increased 13-fold and reached almost 42 million, i.e., about half of the population are supplied with gas. During the Ninth Five-Year-Plan period, in 700 towns and urban settlements, new water-supply pipelines were laid, the percentage of flats with a gas supply rose to 65-70 per cent in towns and urban areas and to 40-45 per cent in rural areas. The trolley-bus and underground networks have been extended and those of trade and public catering have been considerably developed. In subsequent five-year-plan periods, the rate of development of municipal services will grow even more. The volume of construction in this field requires large investment and will depend on the level of accumulation.

Shops and public catering establishments also grew in numbers between 1960 and 1975. The number of shops increased by 26 per cent and their trading area doubled; the number of public catering establishments increased by 92 per cent and their capacity rose by 200 per cent. This is

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transport. The car occupies an area of from 20 m^2 when parked to 250 m^2 when in motion and carries on average two passengers. The bus replaces 30 to 40 cars, while occupying less than a fifth of the area that they would. At the same time, the price of a bus is only double that of a car. As far as transportation capacity is concerned, in the course of one hour eighty trams, ninety trolley-buses and 100 buses can pass down a street without hold-up, while the underground can carry 40,000 people an hour in one direction (at a cost of construction equal to 8-16 million rubles per km). Recently, there has been increasing talk in Western capitalist countries of the need to copy the example of the USSR in the development of urban transport.

a considerable increase, but is still not enough, considering the rise in the Soviet population's living standards and in demand.

Development of communal services is of considerable significance for raising the standard of living and, above all, freeing women from arduous home chores. The number of service enterprises increased from 135,800 in 1960 to 263,000 in 1975, and the volume of services they supplied rose from 1,014 million rubles to 6,579 million rubles. This is a substantial rise, but is still insufficient, particularly compared with the volume of retail trade—about 3 per cent of it. The most numerous of such enterprises are hairdressers', public bath-houses and showers (77,000), tailoring and clothes repair shops (43,000), shoe repair shops (31,000), domestic appliance and radio repair shops (33,000), and flat repairs (10,400). There is still a shortage of laundries (4,400) and dry-cleaners. In terms of the volume of services, the second place after tailoring and clothes repair shops (1,300 million rubles) is held by repair and construction organisations (893 million rubles), followed by metal-ware repair shops (983 million rubles), hairdressers' (515 million rubles) and shoe repair shops (492 million rubles).

The rise in the living standards of the rural population must be mentioned in particular. Of decisive significance in eliminating the considerable difference between town and country are industrialisation of agriculture, an increase in the amount of machinery used in agriculture, the creation of agro-industrial complexes and the transformation of agricultural labour into a form of industrial labour. Much has already been done in this field. Agriculture is equipped with tractors, combines, motor vehicles and agricultural machinery and supplied with large quantities of fertilisers. Large investments are allotted to develop agriculture further. All this will ensure a gradual merging of the two forms of socialist property, i.e., state and co-operative, into a single national property. Only on this basis can one of the major tasks of the development of socialist production relations into communist ones be solved—the elimination of the differences between town and country. One more precondition is also necessary for this, however:

living conditions in rural areas must be brought up to the level of the towns and urban settlements. This means modern housing, municipal services, the supply of cultural, recreational and domestic needs, education and health services. Improvement of the living conditions of the rural population also requires substantial investment. The complex organisational problems connected with changes in the distribution of the rural population and the amalgamation of minor populated localities must also be solved. We shall return to this problem later in the chapter on the development of agriculture.

3. THE SOCIAL PROGRESS OF THE SOVIET PEOPLE

The foundation for the rise in the population's material welfare, cultural level and needs is the development of social production. This is also the basis on which social relations can further be developed and socialist production relations grow into communist ones. The growth of production and satisfaction of the rising material needs accelerate changes in the social psychology of the Soviet people. They make it possible to concentrate their thoughts on spiritual values, on the higher goals of general welfare, comradely assistance and co-operation, social interests and the cultivation of communist ideology. Important signs of social progress are the growth of the educational level, rising skills, new attitude to labour, better health, and improvement of social security. The successes achieved in these fields are among the major achievements of socialist construction.

Before the Revolution, according to the 1897 census, 72 per cent of the population between the ages of 9 and 49 were illiterate. During the first few years of Soviet power, the number of illiterates (according to the 1920 census) dropped to 56 per cent (and among the population of all ages, to 68 per cent). Illiteracy has now been totally eliminated.

Major achievements of socialism are the growth in education, the training of large numbers of skilled personnel in technology, economics, the health service and culture. It

was thanks to these people that industrialisation was successfully achieved, new machinery put into operation in industry, agriculture and transport, and high rates of development have been achieved in the economy. Literature, the fine arts, the theatre and cinema have all been extensively developed.

The number of people with higher and secondary (complete and incomplete) education had reached 16 million by 1939; by 1959 the figure had risen to 58.7 million and on January 1, 1976 it had reached 121.5 million. This means that in 1939, there were 108 people with higher or secondary education out of every thousand over the age of ten, while in 1959 there were 361, and in 1975 there were 570. Counting only those employed in the national economy, these figures rise to 123, 433 and 767, respectively, including 13, 33 and 87 graduates from higher educational establisments.

In order to train such a large number of higher- and secondary-school graduates, the number of students had to be greatly increased. In 1975/76, 93 million people, or a third of the Soviet Union's population, were studying. Of these, 49 million were in general schools of all types, 2.2 million in vocational and factory-run schools, 4.5 million in secondary specialised educational establishments, and 4.9 million in higher educational establishments. During the Ninth Five-Year-Plan period alone, about 9 million people graduated from higher and secondary specialised educational establishments (including 3.4 million higher-school graduates). About 4 million engineers and technicians, more than 1,000,000 agricultural specialists, 900,000 doctors and other medical workers and 1,800,000 teachers and workers in the field of culture were trained. The task of raising the general educational level is being achieved on the basis of Party directives on completing the transition to universal secondary education of young people during the current five-year-plan period.

Since the Revolution, more than 100,000 schools have been opened, more than 30,000 in cities and 70,000 in rural localities.

The training of competent personnel must yet be improved. More than five times as many engineers graduated from

the higher educational establishments in the USSR than in the USA. The number of graduate engineers employed in the Soviet economy is 150 per cent higher than in the USA. During the Ninth Five-Year-Plan period, the total enrolment in higher educational establishments rose by 8 per cent, including a 17 per cent increase in full-time students. The average annual increase in enrolment was 1.6 per cent and 3.2 per cent, respectively. The enrolment in secondary specialised educational establishments increased by 8.5 per cent overall, including a 12 per cent increase in full-time students. In the future, the enrolment in secondary specialised and higher educational establishments will increase in keeping with the requirements of the national economy and also the growth in the numbers of secondary school leavers (by 30 per cent from 1971 to 1975).

The growing need for education is inherent in the developing socialist society. Soviet people want and must receive an all-round education and cultural training. This is essential not only to comply with the needs of expanding production and modern technology, but also in the interests of society, the family, the bringing-up of future generations and, finally, in the interests of each individual. All this is taken into account in planning the number, skills and specialisation of higher- and high-school graduates. It is important for the numbers and specialities of personnel with higher and secondary education to correspond to requirements. To this end, more specialists with secondary education are required. No small role in attaining the right proportions between the supply and demand for engineering and technical personnel must be played by material incentives and the correlation between wage levels.

The need for personnel of all specialities is growing, particularly in the new professions that are of considerable significance for technological progress. In recent years, the training of computer maintenance engineers, automatic control systems operators, designers, biologists, chemical engineers, etc. has developed at the fastest rate. With more and more people trained, the demand for these professions is far from satisfied. In the future, the training of personnel in these fields will gain momentum. At the same

time, however, the training of teachers, economists, doctors and others is just as important.

Along with the expansion of personnel training in all fields, and in the leading ones that determine technological progress in particular, the retraining of personnel is acquiring increasing importance. The rapid development of science and technology means that knowledge soon becomes obsolete and must be constantly brought up to date. According to some calculations, 50 per cent of the knowledge acquired by graduates becomes out-of-date on average every five years, meaning that "depreciation" runs at roughly 10 per cent a year. For this reason, several personnel retraining faculties have been set up at higher educational establishments in the USSR. Retraining institutes and a Management Institute under the USSR Committee for Science and Technology have been set up. In the future, the network of such establishments must be extended and the numbers of persons refreshing their knowledge must be increased to deal with the task of skilled personnel constantly renewing and improving their knowledge. Nowadays, a fifth of all industrial personnel, up to three million engineers and technicians, improve their skills every year.

Modern industry and other sectors of the national economy require not only competent specialists at the middle and high levels, but also highly skilled workers. Nowadays, workers operating computers, automatic production lines and modern chemical plant require knowledge on the level of the technician, or even the engineer. Machine-tool operators must be highly skilled too. Meanwhile, the demand for highly skilled workers is far from satisfied.

Supplementing the ranks of industrial personnel with modern-type workers with secondary or secondary technical education, qualifications, skills and experience, constitutes an important step towards elimination of the fundamental difference between mental and physical labour and thus towards improvement of socialist production relations. These educated and skilled workers can, in the future, form a group of foremen, workshop chiefs, and enterprise managers and administrators.

The socialist state invests enormous sums in education. In 1940, the figure was 2,000 million rubles; by 1950 it

had increased to 5,400 million, to 8,500 million in 1960, to 19,800 million in 1970, and to 26,300 million rubles in 1975. In the future, the state's expenditure on education will increase substantially. The training of a specialist in a higher educational institution costs from four to six thousand rubles; the cost in a secondary technical school is from 2,000 to 2,500 rubles, and in a secondary school is 1,200 rubles. This means that 60,000 million rubles are invested in the 12 million university graduates, and 7,250 million in the 2.9 million people with incomplete higher education, taking the expenditure on them to be an arbitrary 50 per cent of that on a graduate. The training of 18.7 million people with secondary specialised education costs about 42,000 million rubles, of the 34.4 million with general secondary education, 41,300 million rubles, and of the 53.6 million people with incomplete secondary education (also counted at a rate of 50 per cent) costs 32,160 million rubles. In all, about 182,700 million rubles have been spent on the training of people with higher, secondary specialised and general secondary education. These figures show the value of the knowledge received by the Soviet population and how considerable this knowledge is in comparison with the other components of the national wealth.

The increase in the level of education, skills, culture and communist consciousness determine a new attitude towards labour. Labour turns from a means of existence into a prime necessity reflecting man's natural inclination to create. At the same time, interest in his work acquires ever greater significance for the worker. Even today, many young workers seek a job that is primarily of interest to them and corresponds to their desires, even if the job is complex and hard. In the future, it is this need for work to be interesting that will become decisive. Man's desires in the period of developed socialist society and the gradual transition to communism must be taken into consideration even at the present stage. The need to replace heavy physical labour with machinery, to automate monotonous production processes and to improve labour conditions is becoming increasingly pressing.

One of the benefits men enjoy in a socialist society is spare time. Marx wrote that "... free time, *disposable time*,

is wealth itself...".[1] There are a number of factors working to increase spare time, including above all the shorter working day, which depends on the growth of the productivity of labour. The working day in the USSR is seven hours (average working week in industry is 40.7 hours) and for some categories of workers only six hours or less, with a six-day or five-day working-week, instead of the ten to twelve hours that was the rule in the industry of pre-revolutionary Russia. The average length of the working day of a collective-farm worker is seven hours, against the sixteen or more hours during the summer season for peasants before the Revolution. The shortening of the working day gave workers three to five, or even more, extra spare hours. Spare time also increases thanks to the cut in the time spent on travelling and purchasing consumer goods, and to the improvement in services owing to the development of municipal and domestic services, and so on. Rational use of leisure time depends not only on the workers themselves, but on social measures, on the workers being provided with the opportunity to indulge in sport, art, handicrafts, collecting items of interest, improving their knowledge, and so on.

Achievements in the health service are of great social and economic importance. In the USSR in 1975, there were 835,200 doctors, or 32.8 doctors per ten thousand of the population, and 3.0 million hospital beds, 118 per ten thousand of the population. These figures put the Soviet Union in first place in the world. Between 1965 and 1975, the number of doctors in the country increased by 50 per cent and that of hospital beds by 35 per cent. All factory and office workers in the USSR use polyclinics, and dispensaries free of charge. In 1975, there were 58,000 such establishments. Measures are being taken to prevent occupational diseases. Between 1965 and 1975, the number of cases of scarlet fever dropped by 40 per cent, of diphtheria by four per cent of the 1965 figure, of whooping-cough by 8 per cent, and of measles by 17 cent. This fall in the occurrence of these diseases is due to the increase in the population's living standards

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[1] Karl Marx, *Theories of Surplus-Value*, Part 3, Moscow, 1975, p. 257.

and improvement in the health services. It has an effect economically by reducing the working time lost due to illness. Considerable attention has been devoted to mother and child care and measures to combat infantile diseases ever since the first years of Soviet power, and this has resulted in a fall in the death rate among children up to the age of four from 133 per thousand in 1896-1897 and 78.9 in 1926 to 8.2 in 1974-1975. Considerable concern is shown for the leisure and health of the working people. In the USSR in 1973, there were 5,675 sanatoria, holiday homes and rest homes with a capacity of 1,006,000 people. The total number of people spending their holidays in these establishments in 1975 was 12.3 million. Moreover, 21 million children spent their holidays in Pioneer and school camps and 9.2 million adolescents in tourist centres and camps.

The economic growth in the country has made it possible to improve the social security of the working people substantially. At the beginning of 1976, there were 46 million people, including 12 million collective-farm workers, receiving pensions. In 1971, the minimum pension rate was raised and the same pension terms were extended to cover collective-farm workers as apply to factory and office workers and their families.

The right to work is a great social benefit enjoyed by the Soviet working people and is written into the USSR Constitution. There is no unemployment in the Soviet Union. This has not only a material, but also a tremendous moral significance, giving the working people confidence in their future.

CHAPTER VII

SCIENTIFIC AND TECHNOLOGICAL PROGRESS AND THE DEVELOPMENT OF SOCIALIST PRODUCTION

1. THE EFFICIENCY OF THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY

The scientific and technological revolution is characterised by a high rate of development of science and technology and their increasingly wide incursion into all sectors of the national economy. During the entire history of human society, the development of knowledge and its application was a slow process. Such implements of labour as the wheel, the hammer, the lever, the spade and the millstone remained virtually unchanged for centuries and in the Middle Ages differed little from their ancient forerunners. Changes in the implements of labour only began to take place in recent times, particularly when, during the industrial revolution, natural forces such as the wind, water and later steam, began to be used and machines constructed. There was further progress during the 19th century with the development of industrial capitalism. In the 20th century there has been an enormous acceleration of scientific and technological progress, especially in recent decades. Aviation made its first steps at the beginning of the century, to become the main form of long-distance passenger transport at the present time. Automobiles and radio were only just beginning to develop at the turn of the century, while they have long since become common means of transport and communication. The last 30 to 40 years have seen the development of television, nuclear power, rockets and space exploration, and computers. Man has flown to the Moon, landed on it, studied it with the aid of robots responding to orders from Earth. Plastics, synthetic fibres and antibiotics have come

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into use and the transplantation of organs is now an accepted practice. Every five years, every year, is a step in the increasingly rapid advance of science and technology. Man is on the threshold of new discoveries: controlled thermonuclear reactions and the use of thermo-nuclear power for peaceful purposes, new substances, including hybrid materials of unprecedented durability and with other qualities not found in natural materials, control over the sex of living creatures, the treatment of malignant tumours, and so on.

By far the greatest opportunities for science and technology to flourish rapidly are created in developed socialist society, in which the main goal is to raise the welfare of the people. Increasingly larger sums required for the development of science and technology are allocated according to plan and the results of discoveries become common property. At the same time, all possible conditions are created for the fullest use of science as a direct productive force.

Scientific and technological progress has already yielded the Soviet people valuable results. Ever more advanced instruments of labour are being used and the quantity of consumer goods and other items is increasing to satisfy the growing demand. The level of education, culture and self-consciousness of the people is rising—an essential precondition for the application of modern science and technology.

To assist the development of science and technology, the socialist state is increasing the share of social labour spent on research and is raising its share in used national income. It is increasing the number of scientific workers and consolidating the material base of science, extending the network of scientific establishments and improving the scientific information system.

Science and technology advance in various ways. This is why evaluation of the efficiency of science, and justification for and selection of the most expedient lines of development are of great importance. Research into the efficiency of scientific and technological progress is aimed at comparing expenditure on science and the effect it yields. Data on the efficiency of science help in selecting the most important lines of scientific development and of influenc-

ing production technology. The difficulty in determining the efficiency of science is that, even though expenditure can be measured, the results are often impossible to calculate. This is particularly true of fundamental research in the natural sciences—mathematics, astronomy, physics and chemistry, if the results are not immediately applied. In this case, one can only get a very approximate idea of the future effect. It is even more difficult to assess the effect of research in the humanities—philosophy, history and linguistics. More reliable calculations can be made of the efficiency of applied science, but there are difficulties even here.

The effect of applied research can be determined once it is implemented, having calculated the so-called economic potential for maximum and partial application. Economic potential is measured by the maximum economic effect that can possibly be derived from introduction of the results of the research into production. The magnitude of this potential is the difference between expenditure on the existing and the new technological equipment, allowing for the volume and period of application:

$$E_T = [(C_1 + E_n K_1) - (C_2 + E_n K_2)] A_T$$

where E_T is the economic potential for year T;
A_T is the expected annual volume of production in year T;
C_1 and C_2 are the production costs per unit of output using the old and the new equipment in year T;
K_1 and K_2 are the specific capital investments for both versions;
E_n is the norm of the coefficient of efficiency.

The question arises of how to distribute the economic potential among the participants in the entire development process—from the scientists' idea, its scientific substantiation, its realisation and experimental testing, to its broad introduction into production. The outlays of each link in the development chain must obviously not serve as the basis for this distribution: in this case, the creative element, on which all the development and application depend, would

be clearly undervalued. At least correction factors are needed, but these have not yet been elaborated enough. It has been suggested that research and designing be attributed from 30 to 50 per cent of the total effect of innovation, while construction and preparation for production account for 20 to 35 per cent and operation and organisation of production for 25 to 40 per cent. These figures cannot be identical for all types of research: a differentiated and, in many cases, individual, approach is needed.

In general, no satisfactory solution has been found to the problem of determining the efficiency of science. Further study is necessary, all the more so since during the scientific

Table 17

Investment in Research in the USSR and the USA

	1940	1950	1960	1970	1972	1975
USSR: investment in science, thousand million rubles	0.3	1.0	3.9	11.7	14.4	17.4
as percentage of the national income	0.9	1.8	2.7	3.9	4.6	4.8
USA: investment in science, thousand million dollars	0.9	3.0	13.7	26.6	29.2	33.5
as percentage of the national income *	0.9	1.0	3.5	4.6	4.5	3.9

* The national income calculated according to the USSR Central Statistical Board method. Data for 1975 estimated.

and technological revolution, technological progress is the foundation for economic growth and the level of labour productivity depends upon it.

Let us look at the trends of investments being made in the development of science.

From 1960 to 1975, investment in science in the USSR more than quadrupled, while in the USA it increased 2.4 times, but the absolute size of investment in the USA is 50 per cent higher than in the USSR, calculated at the official exchange rate. The share of this investment in the national income

is somewhat lower in the USA, however, than in the USSR. From 1971 to 1975, investment in the development of science and technology increased by more than 60 per cent in the USSR over the five years from 1966 to 1970.

In recent years, the growth rate of investment in science in the USA has slowed down. From 1955 to 1960, for instance, it more than doubled, from 1960 to 1965 it increased by 50 per cent, from 1965 to 1970 by 29 per cent, or at 5.3 per cent on average per annum, and from 1970 to 1974, by only 20.7 per cent, or 3.9 per cent on average per annum. Of the total of 32,100 million dollars, in 1974, 21,525 million are spent on industrial research, including 13,000 million coming from industry itself. Universities and colleges receive 3,810 million dollars and 4,800 million are spent on research carried out by state organisations. Total government investment in research and development amounted to 17,383 million dollars, of which 9,429 million went to research of a military nature, 2,458 million on space research, and 5,500 million on civil needs: the health service, education, labour resources, nature conservation, economic research, and so on. Investment in defence research dropped slightly between 1968 and 1971, but later rose to the highest level in recent years. Investment in space research has been falling every year since 1966. It must be remembered that financing of the Apollo moon-probe programme which cost 26,000 million dollars was cut off. Investment on other research has somewhat increased. The *U.S. News and World Report* writes that the share of investment in science in the GNP began to fall by 3 per cent a year at constant prices in the mid-1960s.

As a result of this slowing-down of the growth of investment in science in the USA, in countries such as Japan, Sweden, Britain and Holland, the proportion of scientists involved in research is now greater than in the USA, and so is the number of patents in West Germany, Sweden and Holland. The per capita social product is growing faster in Japan, in Western Europe and in the USSR than in the USA, and exports of modern technology, including electronic devices, computers and aircraft, from the USA have been virtually stable since 1960, while those from other industrialised countries have doubled. During the last

decade, twice as many people graduated from technical higher educational establishments in the USSR as in the USA.

The development of science throughout the world can be judged indirectly from the increase in the number of scientific journals. UNESCO estimates that this number increases tenfold every fifty years: in 1800 there were a hundred scientific journals, in 1850 there were a thousand, in 1900, 10,000, in 1950, 100,000 and it is to be expected that in the year 2000, the number of scientific journals will reach the million mark. With this snow-balling increase in scientific information, it is becoming increasingly difficult even for specialists to keep up with it and the need for modern means of information storage is becoming ever more acute.

The share of fundamental research in the total investment in scientific research is much lower than that of applied research and development. In the USSR, about 12-13 per cent of investment in science is made in fundamental research and the numbers employed in it in the USSR Academy of Sciences, the Academies of Sciences of the Union republics and of each industry constitute approximately 10 per cent of the total number of scientific workers.

Although the share of investment in fundamental research is substantially less than in applied research, the significance of this research for the applied sciences, technology and production would be difficult to overestimate. The time has long passed when the greatest discoveries in technology resulted from the work of practical experts without special training.

The achievements of modern technology are based increasingly on scientific discoveries. Scientific research was the basis for such achievements of modern technology as X-rays, followed by holography, radio and television, rocketry, nuclear power generation, new substances, new ways of treating diseases and so on. Modern technology follows increasingly directly and closely behind science and the time gap between them is decreasing. Another specific feature of the development of modern science and technology is that they have ceased to be the results of the work of individuals. The advance along new and as yet unexplored paths of research and practical development of scientific

discoveries require the combined activities of groups of various institutes, laboratories, design organisations, plants and construction organisations working on a co-ordinated plan. Such comprehensive programmes, including representatives of fundamental and applied science and production, have been compiled both in the Soviet Union and in other countries for a number of major projects, with a large measure of success—for nuclear power, rocketry and space exploration, and the creation of industrial complexes.

The leading role of modern science in scientific and technological progress does not mean that technology, production and society as a whole are relegated to a passive role. In a socialist economy, society and the state present science with its most urgent tasks, taking account of possible future lines of development. At the present stage, when the development of science is becoming more and more accessible to the broad masses, the possibilities are becoming greater for setting scientific collectives major tasks in the sphere of fundamental and applied research and development and application of their results in production. Comprehensive target-oriented programmes are also presented by the state to science and production and supported by large funds. In the USSR such target-oriented programmes are becoming the system and basis for the planning of scientific and technological progress and raising the productivity of labour. These programmes in fundamental and applied research and the application of its results in production serve as the foundation for determining the development of the material base of science, the personnel and investment in research.

A large part of expenditure connected with research goes to pay scientific workers, whose number is growing rapidly in the USSR. In 1940, there were 98,000 scientific workers, 163,000 in 1950, twice as many, 354,000 in 1960, 2.6 times as many—927,000 in 1970, and 1,223,400 in 1975. These figures included 32,300 Doctors of Science and 326,800 Masters of Science. A large proportion had academic ranks: there were 22,900 full and corresponding members of Academies of Sciences and professors, 87,900 senior lecturers, 53,300 senior scientific workers and 45,000 junior scientific workers and assistants. In all, there were 359,100 with degrees in science, including 209,000 with

academic ranks. The number of scientific establishments (including higher educational institutions) increased by 126 per cent from 1940 to 1975 to 5,327. These included 20 academies, 20 divisions, scientific centres and branches of academies, 2,245 research institutes, 481 branches and divisions of research institutes, 446 scientific and experimental stations, 462 museums, and so on.

In the USA, the number of scientific workers was 355,600 in 1972.[1] This is 60 per cent more than in 1964, an average annual growth of 5.8 per cent (the average annual growth in the number of scientific workers in the USSR for the same period was 8.6 per cent). Data on the absolute numbers of scientific workers in the USSR and the USA are not directly comparable because of differences in the scope and methods used for calculating these figures. In particular, in the USSR, all those who have higher degrees and academic status, and also specialists without these but performing research work in scientific establishments, industrial enterprises and design organisations, and also lecturers in higher educational institutions, are all included in the number of research workers. Many lecturers, however, do virtually no scientific research. On the other hand, in the USA the number of scientific workers includes only those directly involved in research, and the actual numbers are reduced to a figure based on the actual time spent on research and development.

This means there is no foundation for concluding that in the USA scientific research is far more productive, even though the number of research workers is substantially less. In fact, the number of research workers in the United States is only slightly lower than in the USSR—according to some estimates, about 10 per cent. At the same time, in the USA and other developed capitalist countries, there are two to three times as many technical assistants per research worker as in the Soviet Union. The number of auxiliary personnel per research worker in the USSR must be increased, as this helps towards a more efficient utilisation of highly qualified research staff.

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[1] *Statistical Abstract of the United States*, 1974, pp. 534.

The share of expenditure on research equipment in all investment in science is much lower than that of salaries. During the last decade, this share of expenditure on research equipment (not including capital investment) in the USSR has risen from 6.5 to 8 per cent, but this growth rate is still inadequate. Modern research equipment calls for large investment: millions of rubles are spent on setting up synchrophasotrons, oceanographical ships and radio-telescopes. In the age of the scientific and technological revolution, even the most advanced equipment soon becomes obsolescent and so, if it is not constantly improved, its capacity and resolving power and so on are not raised, no new discoveries can be made in fundamental research. In order that the growing demand of scientific establishments for equipment could be met, the production of scientific apparatus must be developed more rapidly, for which purpose a special sub-branch of industry should be set up. The fact is that research apparatus is often only required in very small quantities, so small that it is not profitable for general instrument-making plants to produce them.

An ever-increasing role is being played in scientific research by scientific experiments staged under industrial conditions. To this end, experimental stations of scientific establishments and scientific production associations are being set up under scientific research institutes, which have their own design bureaux and factories. The experiment of setting up such associations has proved justified and should be extended.

Scientific and technological progress includes both the further improvement and more wide-spread application of existing technology, and the creation of fundamentally new technology, opening up new paths for technological progress. At each moment in time, its introduction is only just beginning. Such technology includes, for example, fast-neutron nuclear reactors, cryogenic power transmission lines and battery driven cars. Technology already tested but not yet in wide-spread use includes, for instance, automatic and mechanised production means, computers, lasers, hybrid materials. The net effect of the wide-spread application of tried and tested technology is much greater than that of entirely new technology in the short

run. Over a 15-20-year period, however, the efficiency of technology fundamentally new at the given moment, and opening up new paths of progress, assuming its introduction on a sufficiently wide scale, substantially exceeds that of technology that is already used on an industrial scale. By the time this happens, however, and the overall effect of this new technology is sufficiently high, it will no longer be new and will be replaced by even newer technology, about which today we can have only a general idea.

The direct effect of the new technology must be distinguished from the full one. Direct effect is produced by the introduction of new technology. If the new technology is superior to the best already in use in terms of capacity, concentration of production and productivity, it is comparatively easy to calculate its effect. In this instance, specific capital investment and production costs, as a rule, decrease, and the productivity of labour rises. This is the case, for example, when more powerful turbines are used in electric power stations, blast furnaces and other plant of larger capacity are used in the iron-and-steel and chemical industries, and so on. For a given volume of investment in new technology, the sum total of direct effects can be determined by calculating them in relation to the average level of technology already in use. In all these instances, it is a question of determining the economic effect of the tried and tested technology, though of greater capacity.

It is more difficult to calculate the efficiency of fundamentally new technology in such fields as energetics, atomic engineering, metallurgy, electric processing of metals, and so on. To calculate the efficiency of technical innovations, the technical effect derived from their use needs to be worked out in detail as the basis for calculating economic effect. Capital investment can increase at this stage. The efficiency of new technology will depend, in this case, on current costs being cut, if these are great enough to cover the additional capital investment within the normal expected pay-off period.

This is how the direct or branch economic effect of new technology is determined. In order to obtain the full national economic effect of new technology, the direct effect calculated as being received in the given enterprise or

industry as a whole must be added to the effect derived in other enterprises and in other industries throughout the economy from the use of the product under analysis. For example, the effect of developing electricity generation is defined not only by the fall in its production cost or improvement in other economic factors thanks to the growth in the volume of production and the application of more powerful and advanced plant. Besides, it is especially important to take account of the effect of the increasing use of electricity in other sectors of the national economy due to the rise in labour productivity and fall in material expenditure.

The increasing use of electricity in industry makes possible the wide-spread use of automatic machinery, electric furnaces, metal-processing by electric current, and so on. In agriculture, electricity opens up more opportunities for replacing manual labour with machinery and automatic devices in the initial processing of agricultural raw materials, the preparation of feeds, cattle maintenance and in many other processes, and thus for a sharp increase in the productivity of labour and a growth in output. Electricity is widely used in transportation, municipal services and daily life, and everywhere results in saving of live labour, materials and instruments of production. In general, the saving that results can be calculated by determining the saving of live labour and fall in material expenditures.

The sum of direct outlays saved in the given branch and in other branches gives the total economic effect of the use of the new technology.

Let us consider some of the main trends of scientific and technological progress in the future.

2. ELECTRIC POWER

Technological improvements of existing plant in electricity generation consist mainly in an increase in the capacity of both power units and electric power stations as a whole. Even ten years ago, the largest units at thermal electric power stations had a capacity of 200,000 kw, and new ones of 300,000 kw were being built. Turbines with a capacity of 225,000 kw were installed in the Bratsk hydro-electric power station, while those of the Krasnoyarsk hydro-

electric power station have a capacity of 508,000 kw each. During the Eighth Five-Year-Plan period, units with a capacity of 500,000 and 800,000 kw were constructed for condensation electric power stations. During the Ninth Five-Year-Plan period, thermal electric power stations were built with units of this capacity and an even more powerful unit of 1,200,000 kw has been completed and put to test. In accordance with the instructions of the 25th Congress of the CPSU, during the Tenth Five-Year-Plan period the installation of 500,000 and 800,000 kw units and of nuclear reactors with a capacity of 1-1.5 million kw will continue.

With the transition to units with increasing capacity, the growth in efficiency slowed down, as seen from Table 18.

Table 18

Economic Effect Resulting from Transition to Larger Capacity Plant[1]

Capacity of electric power station, thous. kw.	Capacity and number of units, thous. kw	Vapour pressure, atm. abs.	Temperature of vapour superheating at 0° C	Specific capital investment, rubles per kw	Specific expenditure of conventional fuel per kwh	Specific expenditure of metal, kg per kw	Production cost of electricity, kopecks per kwh, from conventional fuels (2 rubles per ton of conventional fuel)
400	4×100	90	535	114.5	375	4.39	0.31
800	4×200	130	565	99.0	333	3.48	0.24
1,200	4×300	240	580	109.3	305	3.37	0.21
2,000	4×500	240	580	97.0	300	2.93	0.19
2,400	3×800	240	580	90.0	289	2.95	0.18

[1] See *The Questions of the Optimal Size of Enterprises in Industry in the USSR*, Moscow, 1968, p. 230 (in Russian).

With a transition from 100,000-kw units to 200,000-kw plant, all the data in the table improve substantially. The increase in the vapour parameters comes virtually to a halt above 300,000 kilowatts, and economic efficiency rises at ever decreasing rates as the plant gains in capacity. Thus, the specific expenditure of conventional fuel falls by 42 g

with a transition from 100,000 to 200,000-kw capacity, but only by 11 g with that from 500,000 to 800,000 kw. The number of personnel falls by 1.00 and 0.05 persons per megawatt, respectively, capital investment by 15.5 and 7 rubles, and production costs by 7 and 1 kopeck. In this way, an increase in capacity with existing technology causes a growth in efficiency that is gradually damped and approaches the limit at which a further increase in the capacity of traditional plant becomes economically inefficient. A transition is then needed to fundamentally new technology. Evidently no great economic result will be achieved by increasing capacity above the 1,200,000-kw mark.

The increase in the capacity of power-generating units means that the capacity of electric power stations also rises. In 1960, there was only one electric power station with a capacity of more than 1 million kw, while in 1965 there were already 12 and by the end of 1973 there were 43 with an overall capacity of 73 million kw. Of these, 12 thermal power stations have a capacity of more than 2 million kw each. With an increase in the number of units, specific capital investment, the power-production cost and the number of personnel per unit of power fall.[1] During the Eighth Five-Year-Plan period, the capacity of the largest operating thermal power stations was 2.4 million kw and that of hydro-electric power stations was 5 to 6 million kw. In the future, thermal power stations will be built with a capacity close to the upper limit of economic efficiency for the capacity of condensation electric power stations.

In the European part of the USSR, a substantial proportion of potential hydro-electric power resources have already been utilised. The country has the largest hydro-electric power stations in the world—the 6-million-kw Krasnoyarsk station and the 4.1-million-kw Bratsk station, and a 6.3-million-kw station is being built in the Sayany Mountains and a 4.32-million-kw station in Ust Ilimsk. Most of the new large hydro-electric power stations are to be built also in Siberia (at Boguchany, on the Middle Yenisei, at Osinovo, on the Tunguska and other hydro-electric power

[1] See *The Questions of the Optimal Size of Enterprises in Industry in the USSR*, Moscow, 1973, pp. 213 and 230; see also *The Planned Economy*, 1974, No. 7, p. 19 (in Russian).

stations). The construction of hydro-electric power stations is much more expensive per unit of capacity than that of thermal electric power stations and necessitates the flooding of large areas to form reservoirs, which should be taken into account when the decision is made to build such stations. On the other hand, hydro-electric power stations are clean, do not discharge any slag or ash, do not create "thermal pollution" of the atmosphere, are serviced by a small number of personnel and do not require the transportation of fuel. These are their considerable advantages which must also be taken into consideration.

When electric power stations and units have a very large capacity, it becomes more difficult to ensure their reliability. If a unit of large capacity is out of order, major economic losses result on a national scale. This makes it essential for electric power stations to be linked into a power system and for increased reserves to be created.

Development of the power transmission network and the construction of super-high tension lines are major tasks. In recent years, the drawbacks in the distribution of investment in electric power stations have to a certain extent been corrected. Previously, the construction of transmission lines took second place to that of electric power stations, which made it necessary for users to build their own small electric power stations. The development of the power transmission network makes it possible to go over to a more efficient centralised supply of electric power from district power stations and to close down uneconomical small stations. Large power systems are being set up that will be incorporated into the Integrated Power Grid of the USSR. As a result, the construction of super-high tension transmission lines is acquiring special significance. The need for such transmission lines is a result, in particular, of the shortage of electricity in the European part of the USSR and the possibility of obtaining much cheaper electricity from the Asian part of the country, where it is in abundance. Work is going on to build transmission lines to carry a direct current of super-high voltage ($\pm$ 750 kv, $\pm$1,100 kv) and alternating current of 1,150 kv.[1]

[1] See *News of the USSR Academy of Sciences*, 1973, No. 10, p. 4 (in Russian).

The use of direct current helps reduce power transmission costs and the number of conductors, allowing insulation to be used with greater effect and the operation of transmission lines to be simplified. Basically new types of power transmission lines are already in the development stage (underground cables, gas-filled aluminium pipes with super-low temperatures and having super-conductive properties). The operation of these lines will produce an enormous economic effect on a country-wide scale.

The need for transmission of electricity over enormous distances can drop substantially with the rapid development of nuclear power engineering, which is only minimally attached to particular regions, since nuclear fuel is transported at low cost and nuclear power stations can be built anywhere. At the present time, a broad programme is being implemented to construct nuclear power stations. The existing Novovoronezh, Beloyarsk, Leningrad and Kola atomic power stations are being expanded and new ones are being built in Kursk, Chernobyl, the Western Ukraine, Smolensk, in Armenia, Kalinin and in Drukšai, equipped with slow reactors with a capacity varying from 440,000 to 1 million kw.

Deposits of uranium are limited, and its cost rises as leaner deposits situated far from the power plants are tapped. The isotope with an atomic weight of 235 needed for existing nuclear reactors, constitutes only 0.7 per cent of natural uranium, while 99.3 per cent is the isotope 238. Uranium-235 is recovered and accumulated in very complex plant. In this connection, the possibility of using fast reactors is acquiring great significance. These reactors turn uranium-238 into nuclear fuel, plutonium, of which about 50 per cent more is obtained than the nuclear fuel used up in the reactor. A reactor of this type, with a capacity of 350,000 kw, is already in operation at the distillation plant in Shevchenko (Mangyshlak Peninsula on the Caspian Sea), and a nuclear reactor with a capacity of 600,000 kw is being built at the Beloyarsk nuclear power station. The discarded fuel elements can be processed at other plant to yield plutonium. As increasing numbers of such reactors come into operation, more favourable conditions will be created for the development of nuclear power.

There are reasons to suggest that, in the future, capital investment in the construction of large-capacity nuclear power stations could be reduced to 130-150 rubles per kilowatt, the production cost of electricity to 0.3-0.35 kopecks per kwh and calculated expenses (including interest) to 0.65-0.85 kopecks. These figures are 20-30 per cent below those for condensation power stations in the European part of the USSR. Even if these prove over-optimistic figures, in any case the sphere of application of nuclear power will greatly increase even in the near future, as large nuclear power stations are already able to compete with thermal power stations in regions where fuel is relatively expensive (in the North, Transcaucasia, the Soviet Far East, and so on), and in the course of time, their share will continue to increase. By 1980, the capacity of nuclear power stations is to rise by 13-15 million kw of installed capacity.

In the more distant future, at the end of the century, it will become possible to make use of the most powerful and extensive source of electricity—thermo-nuclear reactions. For this, temperatures of 100 million °C are required, which no material can withstand. Research is centred on developing plasma thermo-nuclear reactors in which plasma could be heated to the necessary temperature and held by a magnetic field out of contact with the walls for a sufficiently long time (about a second) for the energy generated to be used. It is still too early to speak of the economic aspects, but one thing is clear: judging by the work of physicists in the Soviet Union and other countries, this problem can be solved. In Soviet closed magnetic systems of the Tokamak type developed for retaining plasma, hydrogen ions can be heated to 8 million °C and the hot gas held for several hundredths of a second. Research in this sphere is also taking other directions. Mastery of the energy of thermo-nuclear reactions opens up amazingly broad prospects for the development of the power industry, and, consequently, of all industries. Mankind has almost unlimited supplies of the sources of thermo-nuclear energy—deuterium and tritium, obtained from sea water.

In 1975, the production of electricity reached 1,038,000 million kwh. It is not difficult to calculate the high level that the production of electricity will reach by the end of the

century, if it continues to grow at the present rate. This increase in the generation of electricity will be of enormous economic significance for the whole economy, as it will make it possible to increase the amount of electricity used per worker and, consequently, the productivity of labour. The amount of the electricity used per worker in industry will increase at the same rate as the consumption of electricity, while there will be a comparatively small or no increase in the numbers employed.

The considerable increase in the production of electricity makes it possible to use it on a wider scale, not only as a source of power, but also for production purposes, for the development of electro-metallurgy, the production of electric steel, for smelting cast iron in electric induction furnaces instead of cupolas, using iron-and-steel scrap and waste, for the development of electro-chemistry and for electric-spark processing of metal. The increase in the generation of electricity resulting from the growing capacity of electric power stations, units and power transmission lines, also allows production costs and electric power fees to be cut.

The increase in the use of electricity engenders considerable advances in other sectors of the economy. At the present time, agriculture consumes about 7 per cent of all the electricity produced and the services use about 12 per cent. The use of electricity in these sectors is growing more rapidly than production and their share in the overall consumption of electricity will increase by 50 to 100 per cent.

Electricity will be widely used in agriculture to power stationary machinery and, in the more distant future, it may even be used in the main processes, including ploughing, sowing and harvesting. At home and in the services, more electricity available and lower prices will make it possible to replace manual labour with mechanical and automatic devices, to ease housework, develop the service industry and enable the population to make better use of working time and, at the same time, to raise the productivity of labour.

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3. AUTOMATION AND MECHANISATION OF PRODUCTION

Wide-spread automation of production is one of the characteristic features of technological progress during the period when the material and technical base of communism is being laid, and it produces an enormous rise in labour productivity and ensures abundance of goods. The rate of automation is not yet sufficiently high, however, and the share of capital investment in automation is still small.

In the USSR, automatic apparatus are used in the generation of electricity, iron-and-steel industry, oil extraction and oil refining, in the chemical industry, engineering and the food industry. They are used most frequently in the control and monitoring of production processes. There are several types of production—synthetic fibres, plastics and plastic goods, bakeries and other food enterprises, metal-processing and many others—in which the production process is automated and automatic production lines, workshops and even factories have been built.

In the future, automation will be used more widely in continuous large-scale production processes requiring a high degree of accuracy and high speeds, in industries where contact between people and the materials or products should be avoided (for example, the food industry, in the production of harmful chemicals, in the presence of high radioactivity and the like). The number of automated production processes will expand increasingly.

The tremendous advantage of automation is that it allows large quantities of articles to be produced with a high productivity of labour and at a low production cost. This is why automation is one of the main paths of technological progress. At the same time, the efficiency of automated processes is not always high enough. Their efficiency falls if the cost of automatic equipment is unjustifiably high, if it is not used to full capacity and stands idle for considerable periods of time, i.e., when the measures necessary to ensure the maximum possible effect from the automatic equipment are not taken. In order to eliminate these drawbacks and raise the efficiency of automation, the cost of automated equipment must be cut, particularly in full-scale production. This will only be possible, however, when

such automatic apparatus can be adjusted to process new types of product. This can lengthen the working hours of automatic apparatus and reduce the cost of production. Processed articles must be adapted to automatic equipment in terms of material, shape, etc. This is often quite simple and can simplify processing with automatic equipment substantially and lead to a rise in efficiency. The reliability of components and assemblies in automatic equipment must be raised in order to cut idle time during repairs. In all, this means that, with the transition to automatic processes, all the conditions for their efficient operation must be carefully thought out and all necessary measures taken to make use of their technical and economic advantages.

An important condition for efficient operation of automatic processes is a transfer to large-scale, mass production, which, in turn, necessitates specialisation and concentration of the production of the given article in only a few enterprises.

All this requires a substantial increase in the output of machine-tools equipped with digital control devices, automatic production lines and other means for automating production.

Along with automation of production, the automation of control systems in enterprises and within industries is also of considerable importance for raising labour productivity. It is economically feasible to set up such systems primarily in large enterprises.

By 1975 there were 187 branch automatic control systems in operation in the country, 989 control systems in associations and enterprises, 789 for the control of complex production processes within enterprises and 692 for the control of territorial organisations. The application of automatic control systems made it necessary to set up a large number of computer centres in enterprises, not counting those in scientific research and design organisations. By the end of 1975, a significant part of enterprises in the leading industries had gone over to automatic control. The average pay-off period for all types of automatic control systems is 3.3 years. From 1971 to 1974, the different types of automatic control systems produced an additional 1,200 million rubles profit.[1]

[1] D. Zhimerin, "Automatic Control Systems in the Economy", *Pravda*, June 9, 1974.

During the Ninth Five-Year-Plan period, the output of computer technology rose four times, including an increase of electronic computers. The production of a new generation of computers based on integrated circuits began. A system of interchangeable computers known by the name of Ryad is being developed by the socialist countries. In the next five years, the production of computers will increase very rapidly to ensure their wide-spread introduction into all spheres of the economy.

The country is faced with the tasks of improving the entire information system within the national economy on a unified basis, automating the collection, storage, transmission and processing of information, training personnel and supplying technical equipment to computer centres.

All this is envisaged in the automated system for plan calculations developed under the supervision of the USSR State Planning Committee and its Main Computer Centre.

One of the tasks involved in the further improvement of the use of computers throughout the world is to improve programming techniques. In recent years, as the use of computers has increased, the instructions, programmes and languages used for feeding data into the computer have become increasingly complex and there is a rising shortage of programming experts. The American Univac company states that the number of languages has already topped the thousand mark and they are becoming ever more complex, while the shortage of programming experts in the world was 100,000 in 1974. As a result, computers are usually used to only 10-15 per cent of their capacity, at best to 30-35 per cent. Hence it is not the computer-programming experts who must be taught to deal with the increasing complexities of the computers, but the computers themselves that must be adapted so that they can be used by anyone, just as anyone can use a telephone, radio or television, without knowing exactly how it works. In the future, the problem must also be solved of how computers can be used on a subscription basis by users at a distance by means of keyboards or remote-control apparatus on the user's premises.

All this requires considerable improvement of computers and other electronic equipment, but augurs very great ad-

vantages, and will simplify and greatly improve management and administration of economy, branches of economy and enterprises, and make for better use of available extensive potentialities.

One of the factors behind the growth in labour productivity in industry and throughout the national economy is the mechanisation of production and, above all, of hard manual labour. In the future, there will be a sharp drop in the use of manual labour in industry. A major role will be played in this by the mechanisation of handling operations, auxiliary and repair work in industry, and also of hard manual work in construction, agriculture and transport. Mechanisation in these fields is an indispensable condition for the further development of production, particularly with the limited supply of manpower.

Mechanisation requires an increase in the production of many types of machine and mechanism, conveyors, automatic loaders, suspended monorails and the like. At the present time, the output of these machines is not sufficient, particularly of automatic loaders and conveyors which are the most efficient types of machinery. As a result, many industrial enterprises have to produce the handling mechanisms they need themselves, at high cost and, not infrequently, of low quality by modern standards.

The accelerating growth of motor vehicle output exerts a considerable influence on technological progress in engineering and in industry as a whole. This, in turn, necessitates the mass production of sheet steel, engines, electric devices, and tyres, facilitates the introduction of advanced organisational forms, specialisation, co-operation, and so on. This process will go hand in hand with the increase in the production of motor vehicles. During the Ninth Five-Year-Plan period, the output of motor vehicles increased by 114 per cent, including cars by 250 per cent. The rapid growth in the production of motor vehicles raises the problem of equipping them with devices to reduce the exhaust of harmful substances, such as carbon monoxide and lead, into the atmosphere. In the future, the problem of replacing motor vehicles with battery driven vehicles will also be solved and this will make it possible to halt atmospheric pollution by exhaust gases, increase the opportunities for using oil as

a chemical raw material and also reduce the cost of transportation.

The development of agricultural engineering will further technological progress in agriculture. This issue is dealt with in detail in Chapter XI. In the future, the growth of engineering for the light and food industries will exert an influence on the advance in the production of consumer goods.

4. IMPROVEMENT OF MATERIALS PRODUCTION

In the future, ferrous metals will remain the basic construction material and technological progress in this sphere will mainly take the form of improvement in the organisation and methods of production and increase in the quality of output.

The production of pig iron will become increasingly concentrated. During the Eighth Five-Year-Plan period, the largest blast furnaces were built with a capacity of 2,700 to 3,200 m^3, during the next five years a 5,000-m^3 furnace was built and in the future there will be even larger furnaces, up to 10,000 m^3. A larger furnace yields better results: for example, a 3,200-m^3 furnace produces 56 per cent more metal per annum than a 2,000-m^3 furnace, reduces the capital investment per ton of pig iron by 12 per cent and the production cost by 2-3 per cent. Further increases in capacity, however, do not produce this rise in efficiency. A 5,000-m^3 furnace produces 60 per cent more per annum than a 3,200-m^3 one, while the capital investment per ton drops by only 5 per cent and the production cost by 1 per cent.

More wide-spread use will be made of oxygen and natural gas in blast-furnace smelting, which will increase the output of cast iron with the given capacities. The smelting of cast iron in cupolas can be effectively replaced by smelting in electric induction furnaces using iron and steel scrap. Using 25 per cent of scrap, the drop in production costs of a million tons of cast iron constitutes about 50 million rubles per annum and the capital investment will be recouped within 18 months.

Along with open-hearth furnaces, the future will see a further development of oxygen-blast converter methods

in steel smelting. During the Ninth Five-Year-Plan period, the amount of steel smelted by this method doubled, thus allowing fuel to be saved and the cost of metal reduced. At the same time, the scale of production will increase and this will also have a certain economic effect. For example, with the transfer from three units with a capacity of 150 tons to three with a capacity of 300 tons, the annual output increases by 90 per cent, capital investment per ton falls by 13 per cent and the expenditure per ton of steel by up to 11 per cent. Further increases in capacity are less efficient: three units of 400 tons reduce capital investment per ton by 8 per cent and expenditure by up to 5.5 per cent.

The open-hearth furnace method of steel smelting will also be used, and new large-capacity furnaces (up to 1,000 tons and later 1,500 tons) will be built. Continuous steel casting will be used on an increasingly wide scale, helping to save on capital investment and current costs, reducing waste and the demand for manpower. An increase in the quality of steel and the smelting of alloy steels and special alloys, especially of refractory metals, will be made possible by the development of electric smelting. Technological progress in this field proceeds mainly through the increase in the capacity of electric furnaces and the power of transformers, the use of oxygen and automatic equipment. Capital investment per ton of steel drops by 20 per cent with a transition from an electric furnace of 50-ton capacity to one of 100 tons, and expenditure per ton of converted steel drops by up to 15 per cent. With a further doubling of capacity. capital investment per ton drops by only 10 per cent and conversion expenditure by 6 per cent.

Of considerable importance in rolling practice are the increase in the variety of rolling shapes, the improvement of the quality and finishing of output in order to reduce subsequent processing in engineering to a minimum. There must be an increase in the proportion of rolled sheet to 55 per cent and more of the overall output of rolled stock, an increase in the output of cold- and hot-rolled sheet, cold-rolled stainless transformer and dynamo steels with high electrical characteristics, of tin plate, and also of curved sections, shaped profiles and heat-treated rolled stock.

The increase in the variety of rolled shapes, and in the pro-

portion of rolled sheet in particular, will reduce the amount of metal used per unit of output. The expenditure of metal per unit of output in engineering, although it has fallen substantially during the last ten years, is still very high.

One of the reasons for the large expenditure of metal is the high proportion of cutting operations, which cause wastage in engineering of up to 8 million tons a year, while all wastage including losses, filings, burning-out and so on constitute about 15 million tons per annum. This wastage might be considerably reduced by replacing cutting with stamping, by using welded units from sheet instead of uneconomical types of steel casting, and also by increasing the proportion of high-precision castings with limited tolerances. The use of high-quality metals will make it possible to reduce the weight of individual units.

The strength and wear-resistance of metal is of extreme economic importance. Solid-state physics might provide the means of improving these properties (for instance, by casting metals without dislocations in the crystalline lattice, which could increase the strength of metal structures severalfold, while reducing their weight), and also by heat treatment and shot-blasting. Of great significance in this is protection against corrosion by the addition of alloys, painting, anti-corrosive coating, and so on.

Some of the directions taken by technological progress are improved methods of metal smelting, increased use of oxygen-blast converter methods, continuous steel casting and smelting in electric furnaces, as described above.

One important direction in the materials sphere is the creation of new materials with predetermined properties, and above all of new synthetic materials.

A precondition for the development of synthetics chemistry is expansion of the oil-processing and gas industries, the output of which is used in the production of plastics, synthetic fibres and other materials. The proportion of oil and gas used in the chemical industry is not great in comparison with their use as fuels, but may rise considerably in the future.

Technological progress in oil-processing, as in the power industry and metallurgy, takes the form of concentration

of production and increase in capacity, the use of new production methods and technology. The individual capacities of atmospheric-vacuum plant increased from 350,000-500,000 tons per annum at the beginning of the 1950s, to 1-3 million tons during the Seventh Five-Year-Plan period and 6 million tons during the Ninth Five-Year-Plan period, while the capacity of large works, previously not exceeding 3-6 million tons of processed oil, now reaches 20 to 24 million tons. This concentration of production has had a tremendous economic effect. It has resulted in a drop in capital investment per ton by 10-17 per cent, particularly by shortening the length of pipelines at refineries, reducing the capacity of storage tanks and the volume of factory equipment, and also by saving on land. Processing costs at large plants fall by 40-50 per cent, the productivity of labour rises at new plants by 100 per cent over old plants, and the labour force drops by 30-60 per cent.

Technological progress in the intensification of processing and the composite use of raw materials, chemical processing methods and the new valuable products received from this, co-operation and integration of oil-processing with the production of alcohol and rubber, and automation of production processes all produce a substantial economic effect. Air used instead of water for cooling purposes allows a considerable reduction in the amount of water used and a transfer to a closed system. There has also been a significant increase in the scale of production and transportation in the gas industry. On the basis of the growth in oil- and gas-processing, the rate of development of the chemistry of organic synthesis can be speeded up substantially.

Recent years have seen a rapid development in the production of plastics. The more advanced of these, such as polyolefins, polyvinylchloride and polystyrene are particularly efficient. In 1975, the output of plastics in the USSR reached 2.8 million tons. In the same year, the output of chemical fibres was 955,000 tons, or about a fifth of the overall production of fibres, while the share of synthetic fibres was only 365,000 tons.

In the future, the production of chemical fibres will rise very significantly, with a sharp increase in the share of synthetic fibres.

Hybrid materials, such as reinforced concrete, should be included among the new materials. Such materials as glass-plastics, plastic-coated metals, reinforced polymers and metal-covered wood provide greater strength and longer service. Materials are being used in increasing quantities to produce disposable articles such as towels, tissues, scarves, dressing-gowns and other articles having sufficient durability.

One important achievement of the Soviet chemical industry is the rapid development of the production of chemical fertilisers. From 1960 to 1975, fertiliser production increased more than 6.6 times, and the USSR has now outstripped the USA, producing three to five times more chemical fertilisers than any capitalist country, except for the USA. In the long run, the production of fertilisers must be increased still more. Their quality will rise, they will contain more nutrients and less filler, and the production of concentrated and complex fertilisers will rise substantially.

* * *

This is a far from exhaustive list of the main trends of technological progress. Scientific research is opening up new horizons for development in literally all spheres of human activity. Entirely new production processes are being developed based on the use of laser, ultra-sound, super-high pressure and ultra-low temperatures. Hydro-extrusion and processing by pulsating explosion are coming into use. Powder metallurgy is being developed and the possibility is being studied of introducing processes for reducing iron in which blast-furnaces are not used. Electron-beam, plasma and electroslag remelting methods are in use. The first steps are being taken to create new means of transport—air-cushion and magnetic. The USSR is on the threshold of new discoveries in biology in research into cells, their structure, characteristics, behaviour and so on. These include reliable transplantation of organs, discovery of the causes of malignant tumours and their radical cure, the struggle against ageing and the problem of life and the like. The development of science and technology will exert an ever increasing influence on economic development too.

There are reasons to expect the following major achievements in science and technology in the future: the use of thermo-nuclear power in the power industry and the widespread use of fast reactors; the synthesis of super-hard materials and metals without dislocations in their crystalline lattice; the introduction of lasers in different fields—communications, detection, the processing of materials; micro-miniaturisation; fourth- and fifth-generation computers; automatic libraries; weather control; widespread use of the sea-bed for the development of the mining industry; solution of problems in the struggle against malignant tumours; chemical control over the ageing process; regeneration of organs; artificial foods; new types of artificial leather—durable, fine and porous; the production of motor vehicles that do not pollute the atmosphere, and of battery driven vehicles; disposable consumer goods.

* * *

One of the advantages of the socialist economic system is that scientific and technological progress, being an objective process, is not allowed to take its own course. It is planned and controlled according to the needs of the economy and taking into account the scientific interests of the scientists. Control over scientific and technological progress must act as an all-round stimulant and take all available opportunities to speed up this process.

The production plan must take account of the future development of science and technology. The targets of increased production, higher labour productivity, lower material requirements per unit of output, and so on must be based on the introduction of new technology, its performance and scale. Data on the performance and the scale of use of new machinery, machine-tools and materials can be taken as the foundation for calculations of future output, increases in labour productivity and cuts in production costs. This requires a fundamental improvement in the planning of technological progress, co-ordination of plans for technological progress and production, and their organic interconnection.

Along with an improvement in the planning of technological progress, material and moral incentives must be used to stimulate the development of science and technology, prices and relations based on self-sufficiency.

The transition to new types of output or improved output usually engenders additional expenditure for enterprises, which reflects unfavourably on their profits and reduces their incentive funds.

One of the sources of compensation for the increased expenditures during the first few years that new technology is being manufactured is the innovation fund formed from deductions of between 1 and 4 per cent from production costs of all mass-produced output. These deductions are transferred to the branch ministry which distributes them among enterprises to subsidise the production of specific articles in accordance with the plan for the development of new technology. These subsidies are not, however, sufficient. Another source of compensation is the production development fund formed from the enterprise's profits. In 1975, for all industry expenses from this fund reached 4,388 million rubles.[1] Capital investment made from the production development fund reached 10-12 per cent of all capital investment in industry.[2]

In our opinion, it would be advisable for bank credit to be granted to enterprises preparing to produce new or improved products for the assimilation period of these products with the credit being covered from future profits, which might be considerable. Temporary prices might be set on new types of product on the basis of planned production costs for the first year of full-scale production, with an addition of a 10 per cent profitability rate. An important incentive to produce high-quality products is the award of the state Mark of Quality. In 1972, the Mark of Quality was awarded to 3,200 articles, while at the beginning of 1976, 27,600 products bore this mark.

It is important not only to stimulate the output of new and technically advanced articles, but also to make the

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[1] See *The National Economy of the USSR in 1975*, p. 739.

[2] See G. A. Tsaritsina, *The Economic Incentive Funds for Scientific and Technological Progress*, Moscow, 1973, p. 110 (in Russian).

production of obsolete ones unprofitable. To this end, graded prices are used which reduce the profits from the production of obsolete articles and their further production becomes unprofitable for the enterprise. From 1971 to 1975, about 7,500 obsolete types of machines, equipment and instruments were taken out of production.

Another incentive to the application of new technology on a wider scale can be a cut in the costs of producing new articles as a result of a growth in production based on specialisation and co-operation. Personal material interest in the development and application of new technology must also be promoted.

CHAPTER VIII

RAISING THE PRODUCTIVITY OF LABOUR

1. THE PRODUCTIVITY OF LABOUR AND ITS GROWTH RATE

The productivity of labour, its level and growth rates are major factors in the development of social production and the advantages of the socialist over the capitalist mode of production. Lenin's basic argument that the productivity of labour is, in the final analysis, the most important, the main thing for the victory of the new social system is well known. The growth of labour productivity is of exceptional importance under developed socialism, when production must increase primarily through increased efficiency.

In general terms, the productivity of labour is calculated as the ratio of output to the labour force. For the national economy as a whole, the productivity of social labour is expressed as the ratio of the gross social product or the national income to the numbers employed in material production. In calculations of the productivity of labour for separate branches or enterprises, the gross (or commodity) output is divided by the number of workers or man-hours worked. The result is the corresponding annual or hourly productivity of labour for the branch or the enterprise. Along with value indicators, indicators are used expressed in physical units, such as the ratio of the product in physical units—tons, metres, litres and so on—to the number of workers or man-hours worked.

The indicators used have serious drawbacks, since they do not reflect the difference between the productivity and the intensity of labour. This implies that labour productivity should be calculated for the same intensity of labour, but this finds no reflection in the figures.

Furthermore, these indicators relate output only to the expenditure of living labour, whereas in fact its level depends on the expenditure of both living and embodied labour. Moreover, the volume of output can often only rise as a result of expenditure of embodied labour, given the expenditure of living labour. For example, a larger-capacity machine produces more for the same expenditure of living labour, in which case the productivity of labour is growing as a result of the expenditure of embodied labour. In other cases, for the same expenditure of embodied labour (i.e., the same machine-tools are used), output may grow as a result of the workers being more highly qualified or skilled. These differences are not reflected in existing indicators of labour productivity.

Moreover, the labour productivity figure may also grow when, in fact, there have been no improvements in production. This is because output includes the value of raw and other materials and intermediary products and the ratio may, therefore, increase if, for example, a more expensive raw material is used or the expenditure of raw material per unit of production rises, or also as a result of price rises. All the shortcomings in the labour productivity indicators must be eliminated and the influence of different factors upon them must be pinpointed.

The productivity of labour could be calculated on the basis not of the gross product, but the net product or value-added, excluding all material expenditures or only materials purchased. This approach would relate the net output to the living labour input. If gross or commodity output is taken as the basis, the denominator of the ratio must be the total expenditure of labour, i.e., both living and embodied labour, which can be expressed as the sum of man-hours worked.

Some economists propose taking reduced expenditures as the denominator. If, however, the numerator is gross output as the sum of production costs and profits, and the denominator is reduced expenditures as the sum of production costs and the interest on capital investment, the productivity of labour thus calculated will be close to unity. For individual branches, differentiated factors can be envisaged, such as factors in physical units for the mining industry

and industries producing simple output (glass or cement), net output and value-added for the manufacturing industry, gross output for enterprises with long production cycles, and so on. In this case, however, it would be impossible to compare labour productivity between branches. It would, therefore, be inadvisable to abandon existing factors of labour productivity, which must be supplemented by such factors as the net product and value-added and also output in physical units (all calculated per worker).

Labour productivity figures are of enormous importance in calculating the volume of production for the future, particularly under contemporary conditions when the number of workers in material production is stabilising or even beginning to fall.

The socialist economy is distinguished by a high growth rates of labour productivity. In the 35 years from 1940 to 1975, the annual productivity of labour rose by 557 per cent in industry, 250 per cent in agriculture, 367 per cent in railway transportation and 476 per cent in construction,[1] the greatest increase in labour productivity being achieved in industry. For individual branches of industry, the largest increase in labour productivity took place in those branches that lead technological progress—in engineering, the metal-processing, chemical and petro-chemical industries.

The mean annual growth rates of labour productivity from 1960 to 1975 were 5.4 per cent in industry, 3.7 per cent in agriculture, 5.3 per cent in railway transportation, 5.2 per cent in construction.

In recent years, the USSR Central Statistical Board has started using a new indicator—the productivity of social labour as the ratio of the national income to the number of workers in material production. This indicator does not have the drawbacks of gross output per worker. Indeed, the numerator here is the national income, i.e., the net product, and the denominator is the number of workers that produced this output, i.e., the two are homogeneous quantities.

The productivity of social labour calculated in this way increased from 1960 to 1975 by 119 per cent, meaning an annual increase of 5.3 per cent a year on average.

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[1] See *The USSR in Figures in 1975*, p. 113.

For individual industries, the hourly productivity of labour is defined as the average for one hour's work, and the annual productivity of labour as the average per worker a year.

During the Ninth Five-Year-Plan period, the rate of growth of labour productivity was 6.8 per cent in industry against 5.8 per cent in the previous five years, and 5.3 per cent in construction against 4.1 per cent.

The mean annual growth rate of labour productivity in the USSR industry is higher than in many capitalist countries.

During the Seventh Five-Year-Plan period, the USSR was ahead of the three capitalist countries shown in Table 19 and during the Eighth Five-Year-Plan period, the growth rate of labour productivity in the USSR increased, to put the Soviet Union ahead of the four capitalist countries shown in the table. From 1971 to 1974 it took the lead of six countries.

Table 19

The Mean Annual Growth Rate of Labour Productivity in Industry, in per cent

Year	USSR	USA	Britain	France	FRG	Italy	Japan
1951-1955	8.3	3.4	2.0	4.7	4.9	7.7	12.0
1956-1960	6.6	2.6	2.0	4.8	3.9	8.2	11.0
1961-1965	4.6	4.3	3.2	4.4	4.7	6.2	7.7
1966-1970	5.8	1.8	3.0	6.8	5.5	4.0	12.1
1971-1974	6.0	3.1	3.8	4.4	3.9	3.2	5.2

The accelerated growth rate of labour productivity is of vital importance for the USSR, as the expansion of production depends to an increasing degree on this growth. At the same time, the possibilities for drawing additional manpower into production are decreasing. The fall in the increase in the numbers employed, once 92-93 per cent of labour resources are being used, means that in the near future, the country cannot count on increasing production through a rise in the number of workers, especially as fhe numbers employed in the non-productive sphere will expand.

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Production growing mainly as a result of higher labour productivity long ago became the rule for the development of the socialist economy. According to USSR Central Statistical Board calculations, during the First Five-Year-Plan period (1928-1933), 51 per cent of the increase in industrial output came from the rise in labour productivity, while the figure was 79 per cent for the Second Five-Year-Plan period (1933-1937), 69 per cent for the war years (1941-1945) and the Fourth Five-Year-Plan period (1946-1950), 68 per cent for the Fifth (1951-1955), 72 per cent for the Sixth (1956-1960), 62 per cent for the Seventh (1961-1965), 73 per cent for the Eighth (1966-1970) and 84 per cent for the Ninth Five-Year-Plan period (1971-1975).[1]

During the Tenth Five-Year-Plan period, the rise in labour productivity will provide 85-90 per cent of the increase in the national income, roughly 90 per cent of that in industrial output, all that in agriculture and construction, and not less than 95 per cent of that in the volume of railway turnover. The remainder of the increase in industrial production is due to the rise in the number of workers.

2. TECHNICAL FACTORS IN THE GROWTH OF LABOUR PRODUCTIVITY

The ways to increase labour productivity become clear from an analysis of the factors that influence it. So, planning of the level of labour productivity must take as its basis changes in the trends of technological progress, the assets-worker ratio, the organisation of production, skills, the intensity of labour, material and moral incentives, and so on. Furthermore, once the productivity indicators are planned, they can be taken as the basis for determining the volume of production and all other plan components, provided account is taken of the number of workers.

Raising the technical level of production is of decisive significance for the growth of labour productivity. As a factor influencing the growth of labour productivity the physical growth in the technical level can, to a certain degree, be revealed in an increase in the assets-worker ratio.

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[1] See *The USSR in Figures in 1975*, p. 114.

Table 20

	1950	1955	1960	1965	1970	1975
Industrial output, thousand million rubles	52	95	157	229	373	511
Number of workers in industry, million	12.2	15.1	18.9	22.6	25.6	27.5
Labour productivity (output per worker), thousand rubles	4.3	6.3	8.3	10.2	14.6	18.6
The same, as per cent of the previous period	141*	148	132	123	143	127
Fixed assets in industry, thousand million rubles	30	55	89	150	227	353
Assets-worker ratio, thousand rubles	2.5	3.7	4.7	6.6	8.9	12.8
The same, as per cent of the previous period	...	148	127	140	135	144
Electric power per worker, thousand kwh per annum	5.7	8.3	11.0	15.4	19.5	23.9
The same, as per cent of the previous period	143*	146	133	140	127	123

* As per cent of 1945.

In industry, the growth rates of labour productivity are similar to those of the assets-worker ratio and the amount of electric power used per worker (see Table 20).

It is clear from the table that during the Fifth Five-Year-Plan period, the growth rate of labour productivity was virtually the same as that of the assets and electric power available per worker, while during the Sixth Five-Year-Plan period, it somewhat exceeded the growth of the assets-worker ratio. During the next five years, the growth rate of labour productivity fell and lagged noticeably behind that of the other two factors. During the Eighth Five-Year-Plan period, the lag of the growth rate of labour productivity during the previous five years was made up and its rate of growth outstripped that of the assets and electric power available per worker. At the same time, the hourly

productivity of labour increased only slightly more than the yearly productivity. In 1975, the productivity of labour once again lagged behind the assets-worker ratio and slightly exceeded the electric power used per worker.

In general, labour productivity grows in step with the other two factors, while it should increase faster as a result of organisational factors, higher skills of the workers, etc. It should be noted that the figures for the assets-worker ratio in the table do not fully reflect the technical level of production, since they give the value of the instruments of labour and not their technical level. This means that, even if labour productivity grows in step with the assets-worker ratio, this does not necessarily reflect the influence of technological progress. On the contrary, technological progress might influence labour productivity if the amount of assets per worker does not change, but the technical level is increasing.

The fact is that the increase in the technical level of production takes different courses. The introduction of fundamentally new equipment, materials and production processes may have a substantial effect, though the value of fixed capital may not rise. Nuclear power stations, for example, require considerably fewer personnel than condensation thermal power stations of the same capacity using coal, since all the operations connected with the delivery and use of coal are eliminated. In the future, an even greater increase will probably be achieved in labour productivity with the use of thermo-nuclear power. In the iron-and-steel industry, continuous steel casting raises the productivity of labour in smelting and rolling shops by 20 to 25 per cent, and in the plant as a whole by 3 to 4 per cent. An even greater increase in labour productivity, approximately 50 per cent in comparison with contemporary open-hearth furnaces, is ensured by the use of the oxygen-blast converter process.

A clear example of the increase in labour productivity owing to the use of new materials is the application of the products of organic synthesis. The production of synthetic fibres requires about 35 per cent as much labour as the natural materials they replace—cotton (counting expenditure of labour from the agricultural stage onwards). There are more and more new materials ensuring a growth of

labour productivity in production and in use, including hybrid (reinforced) materials, plastics, and so on. They all lead to a large increase in labour productivity compared with traditional materials without, as a rule, engendering an increase in the assets-worker ratio.

The USSR national economy has large reserves for raising the productivity of labour. An analysis of pertinent data shows that the labour productivity of workers in basic production in the USSR is in general on the level of that of the developed capitalist countries. In other words, each worker in basic production produces no less, and often more, than his counterpart in these countries. The number of auxiliary workers, and especially of engineering and technical personnel and office workers, is sometimes from 50 to 200 per cent higher than in these countries. This is evidence of shortcomings in the organisation of labour in enterprises and in the distribution and redistribution of manpower.

One large reserve for increasing labour productivity is automation and mechanisation of production and automation of management. Automation of production not only cuts the number of workers by half or more, it also changes the composition of the labour force. The number of machine-tool operators drops sharply and that of more highly skilled workers rises. At the same time, all the work must be adapted to the conditions of automatic production. The introduction of automatic systems in management may, according to available calculations, raise the productivity of labour by 10-15 per cent and more.

Labour productivity rises as new technology is used on an increasingly large scale, and so new technology is an extremely important factor in raising the productivity of labour in the future, at the time it becomes most wide-spread.

An important way of raising the technical level of production is to substitute new, more powerful equipment for that already in use. A reduction in the average length of service of equipment itself brings about an increase in labour productivity, especially if the equipment replaced is extremely worn. Calculations show that for old equipment, the productivity of labour is sometimes only a fifth or a sixth of that for new equipment. An increase in the productivity of labour as a result of the introduction of more powerful

Table 21

Personnel Required for Electric Power Stations with Turbines of Different Capacities

Turbine capacity, megawatts	Number of turbines	Total capacity of power station, megawats	Number of personnel required per megawatt
100	4	400	1.7
150	4	600	1.13
200	4	800	0.7
300	4	1,200	0.48
500	4	2,000	0.30
800	3	2,400	0.25

equipment reduces the demand for manpower. As a rule, there is an optimal capacity for each given type of equipment, such as the turbines of thermal power stations.

With the transition to more powerful turbines, the number of personnel per piece of equipment drops—at first sharply and then to a lesser degree—and, once the minimum is attained, it may begin to rise again.

An increase in labour productivity accompanying the growth in the capacity of units is characteristic for other branches of industry, too. For data on the iron-and-steel industry, see Table 22.[1]

With an increase in the capacity of blast and open-hearth furnaces, labour productivity rises, but at a much slower rate.

In the mining industry, labour productivity depends not so much on the concentration of production and capacity of equipment, as on natural conditions (the richness of deposits, their depth, and so on). Shaft-mining of coal yields on average of about 45 tons of coal per worker, while open-cast mining, about 280 tons. For each coal-field, however, given the same mining conditions, labour productivity depends to a large extent on the capacity of equipment. For example, in open-cast mining, giant "walking" excavators raise the productivity of labour in comparison with smaller digging machines.

[1] See *The Economics of the Iron-and-Steel Industry in the USSR*, ed. Prof. N. P. Banny, Moscow, 1971, p. 267 (in Russian).

Table 22

The Growth of Labour Productivity for Blast and Open-Hearth Furnaces of Different Capacities

Blast-furnace shops

Useful volume of blast furnace, m^3	1,033	1,386	1,719	2,000	2,700	
The same, per cent	100	134	161	193	261	
Labour productivity, per cent	100	110	115	122	143	

Open-hearth furnace shops

Capacity of open-hearth furnace, tons	185	220	370	440	600	900
The same, per cent	100	119	200	238	325	486
Labour productivity, per cent	100	118	129	132	140	160

Another factor of technological progress is the electrification of production processes. As mentioned above, the growth rate of the amount of electric power used per worker in industry is close to that of labour productivity. For example, the amount of electric power used per worker rose by 575 per cent between 1940 and 1975, while labour productivity rose by 557 per cent. From 1950 to 1975, these figures were 335 and 353 per cent, respectively, and 117 and 122 per cent between 1960 and 1975. There is some basis for suggesting that the growth rates of these two factors will continue to be closely related in the future. If, for example, the amount of electric power used per worker grows in the future at 6 to 6.5 per cent per annum, the growth of labour productivity will also be approximately the same.

The influence of the amount of electric power used per worker on the increase in labour productivity is largely due to the fact that this is the basis for replacing manual labour by machinery. There were 26.4 million workers in industry in 1972, of which 13.7 million were manual labourers, while the figures for construction were 6.3 and 3.5 mil-

lion, respectively. The labour of 9.5 million people in industry and 3.3 million in construction was not assisted by any machines or mechanical devices. In all material production, about 50 million people were engaged in manual labour. If mechanisation cut the number of manual labourers in industry by half, the productivity of labour would increase by 33-35 per cent, on the condition that output remains on its former level. If this drop in the numbers of manual workers were an even process spanning a lengthy period of time, 1.3 to 1.4 per cent of the annual 5.5 to 6.5 per cent general increase in the level of labour productivity would be due to this factor. It should not be forgotten, of course, that in order to replace manual by mechanised labour, capital investment on a fairly large scale would be required, but this investment would not exert a direct influence on labour productivity, which is usually calculated as the ratio of output to the expenditure of living labour. The investment would soon give returns through saving on current

Table 23

	Work carried out				
	with the help of machinery, including supervision of automatic processes	manually assisted by machinery	manually without machinery	manually on the repair and maintenance of machinery	the sum of the last two columns
Industry					
1965	40.3	7.9	40.6	11.2	51.8
1972	44.3	7.1	36.0	12.6	48.6
Construction					
1965	27.7	9.4	60.1	2.8	62.9
1972	34.2	10.0	52.2	3.6	55.8

costs, considering that this saving could reach an annual 18-20,000 million rubles in industry.

Table 23 shows the change in the proportions of those engaged in manual and mechanised labour in industry and construction.[1]

[1] See *The USSR in Figures in 1973*, p. 166.

The growth of labour productivity is also affected by the use of materials that facilitate labour and require a lower expenditure of labour in processing. These include, for example, high-quality dyes that simplify the dyeing process. The extraction of oil and gas requires less living labour than does the mining of coal to produce the same amount of electricity, and so on.

3. ORGANISATIONAL ECONOMIC FACTORS

Along with the application of new equipment and materials, another important factor in raising the productivity of labour is improvement in the organisation of production. With the growth in production, specialisation is acquiring increasing importance. Specialised production requires far fewer workers than does non-specialised. We shall return to specialisation and its efficiency in the chapter on industry, and shall now confine ourselves to studying the close relation between specialisation and co-operation in production and improvement in its organisation. The growing scale of production also necessitates adoption of new methods based on the use of automatic control systems in enterprises and individual branches of production and of computers. The introduction of automatic production lines and machine-tools controlled by digital programmes, of computers, a new communications system and other devices, the elaboration of an information system suited to these methods, the training of programmers, and maintenance personnel, and the retraining of management personnel require vast expenditures. If properly organised, these will yield returns in a fairly short time, from 1.5 to 3 years. The effect of applying automatic organisation and control systems in production is particularly great when they are introduced into large-scale enterprises. Automatic systems for metal-cutting introduced, for example, at 19 rolling mills of steel plants, have raised the annual output of finished rolled stock by more than 180,000 tons and yielded an additional profit of 3.2 million rubles a year, with the equipment installed at a cost of 3.6 million rubles.[1]

[1] D. Zhimerin, "Automatic Control Systems in the Economy", *Pravda*, June 9, 1974.

To improve production management calls for determining the productive capacity of enterprises and their individual shops, auxiliary and other divisions, and bringing lagging and underdeveloped sectors up to the general level of the enterprise. The elimination of bottle-necks (which are often auxiliary and services shops) is of great significance in organising the work of the enterprise according to a strict time-table, in making full use of productive capacity, as determined by the major workshops, and in raising the productivity of labour.

Fuller use of the productive capacity of the enterprise depends largely on its being adequately supplied with all the types of raw and other materials and fuel it needs for uninterrupted operation and on these materials being of a quality corresponding to specifications. The elimination of delays in production in enterprises depends to a considerable extent on this, and so, therefore, does the increase in labour productivity. The task of supplying enterprises with the necessary materials at the right time is not one that depends on planning within each individual enterprise alone, but also on the co-ordination and the necessary reserves being available throughout the entire national economy.

Raising the qualifications and skills of workers is of tremendous importance for raising the productivity of labour. Depending on its nature and particular features, production today demands workers with different skills. Workers in mass professions and with secondary qualifications are needed, as are workers with higher qualifications and a knowledge of modern complex equipment. These workers must have not only a general secondary education, but also specialised training, and as such they are in short supply.

Material and moral incentives also exert a major influence on raising the productivity of labour.

With the introduction of the new economic system, material incentives acquired a significantly greater role and the rate of growth of wages rose: from 1960 to 1966, the average monthly wages rose by 25 per cent, while from 1967 to 1973, they went up by 29.5 per cent. The correlation between the growth of labour productivity and of wages has changed.

From 1960 to 1966, a 0.81 per cent increase in wages meant a 1 per cent increase in labour productivity in industry, while from 1966 to 1970, the figure was 0.72 per cent.

As a rule, wages should not grow more rapidly than labour productivity unless the share of consumption in the national

Table 24

The Growth of Labour Productivity and Wages by Branches of the Economy for 1960-1975 (1960 = 100)

	Labour productivity	Wages
Industry	222	179
Agriculture	172	240
Railway transport	206	191
Construction	202	191

income is raised deliberately and, correspondingly, that of accumulation is reduced. The more rapid growth of wages as compared with labour productivity on state farms and in construction reflects the policy of bringing wages in these two sectors up to the national level.

The theory that enjoys wide currency that the growth rate of labour productivity should always outstrip that of wages is hardly justified, as this would mean an increase in the share of accumulation in the national income, which is only possible for a limited period. In our opinion, wages should increase in step with the rise in labour productivity and in such a way as to stimulate this rise.

There is much to be done to improve the system of wages. The technological progress in recent years has brought an increase in the proportion of workers on time wages. In 1971, about 41 per cent were paid according to a time-plus-bonus system. The share of bonuses in the overall wage fund of workers is 12 per cent and of engineering and technical personnel, 17 per cent.

The share of the basic wage in the workers' earnings is not high enough. In engineering, for example, it constitutes only 40-50 per cent. This share should be increased so that

differentiated supplements to the basic rate could be paid depending on the complexity of the job. The minimum wage rate having risen to 70 rubles a month in 1971-1973, other changes are required in the wage system, namely a rise in the wage rates of workers in the middle wage brackets. The correlation between the salaries of engineering and technical personnel and their basic wage rates should be reviewed, as the shortcomings in this lead to irrational use of specialists.

The shortage of personnel with secondary technical training in relation to the number of engineers (in the economy as a whole, there are only 1.6 technicians per engineer) is sometimes connected with flaws in the correlation between the wage levels of workers, technicians and engineers. It happens that middle-bracket workers are given engineers' jobs in order to raise their salaries, while engineers sometimes perform office or management work. From 1950 to 1975, the number of engineers in the USSR rose from 400,000 to 3,683,000, which is, of course, a welcome trend. Everything possible must be done, however, to make sure that engineers do the job for which they are trained.

The opinion is sometimes heard that, to put an end to the irrational employment of highly qualified specialists, a so-called payment for "labour resources" should be introduced. This means that if an enterprise is made to pay for labour resources, including engineering and technical personnel, into the state budget, as a percentage of the wage fund, this will force it to employ its labour resources more rationally. There is little justification for this hope, however. A payment for "labour resources" will do no more than raise production costs. If the enterprise has to make this payment to the state out of its profits, this will simply reduce the free profits balance paid to the state. The employment of specialists will not improve.

Increasing bonuses for higher labour productivity can act as an important incentive. It would be desirable for the productivity of labour to be included among the factors influencing the funding of the enterprise.

Along with material incentives, considerably broader use can be made of moral incentives. These play an important role in instilling communist consciousness in the Soviet

people, in consolidating a conscientious attitude towards social property and in their concern for bringing as many internal reserves as possible into production.

Moral incentives envisage the singling-out and social encouragement of the best workers by their being awarded diplomas, entered on the Board of Honour, awarded badges of merit and recommended for decorations and medals. At the same time, a social influence must be exerted on less productive workers. A feeling of responsibility for their work must be consolidated and instilled in them, as must a desire to improve, develop and innovate, combat inertia and put social interests above the narrow concept of personal interest. When awarding the Uzbek SSR the Order of the Friendship of Peoples, Brezhnev said that "in contemporary social production with its advanced technology, the role of labour discipline has taken on particular importance. The price of delays, lack of conscientiousness and errors is now on an entirely different scale. A half-hour delay, let us say, for a shovel-wielding labourer is one thing, while a half-hour delay for a man operating a powerful excavator, a combine harvester or a tower crane is a very different matter.... Our ideal is conscious discipline which envisages a conscientious attitude, creative thought and a wide scope for worker initiative."[1]

A clear example of a high sense of responsibility and initiative is shown by the way the construction team under N. Zlobin works. This team of some fifty persons, provided with the necessary materials and equipment, completes a large apartment house in a much shorter time than is usually required. They built the first 14-storey building in 155 days, instead of the usual 225, at a saving of 26,000 rubles, and a second house in 82 days, with a saving of 35,000 rubles. As a result, the average earning of a team member rose from 150-175 rubles to 270-280 rubles a month. N. Zlobin's method has brilliantly justified itself, but as yet no more than 1.5 or 2 per cent of all construction teams are using it. This is because of the difficulties involved in reorganising work and providing materials and equipment on time. Wider

[1] L. I. Brezhnev, *Our Course: Peace and Socialism*, Moscow, 1974, p. 142.

use of this advanced method must be the aim and the way made clear for it, which will also make the organisations producing and supplying the materials and equipment for construction improve their work.

Another form of moral incentive is the development of socialist emulation, control over task fulfilment and the submission of exhaustive reports on time.

During the first five-year plans, emulation was mainly directed towards increasing the volume of production and overfulfilling the targets. Nowadays, under developed socialism with its tremendous volumes of production, rapid rate of scientific and technological progress, increasing complexity of economic planning and management and the high intellectual level of the people, the improvement of quality, utilisation of internal resources and reduction of production costs are growing in importance. The 24th Party Congress and the resolution "On the Further Improvement of the Organisation of Socialist Competition" adopted in 1971 by the CPSU Central Committee after the Congress outlined measures to extend this national movement. During the Tenth Five-Year-Plan period, a fuller combination of material and moral incentives will be achieved, and their influence will increase on the rise in production efficiency, the growth of labour productivity, improvement in the quality of production and economical use of material resources.

The growth of labour productivity depends on the establishment of technically justified rates, which requires considerable work on a highly qualified level, inventories of equipment available, its performance, extent of wear, production methods, and so on. Much is being done, but not to a sufficient degree. The number of technical rates is increasing only very slowly.

In the planning of labour productivity, isolation of the factors that exert an influence on it is of decisive significance. First of all, the role of individual factors must be established on the basis of studies of available data. Thus, according to calculations made by the Labour Research Institute, 70-75 per cent of the rise in labour productivity depends on technical improvements in production, while the remaining 25-30 per cent result from improved production

organisation and other factors. Czechoslovak economists have calculated that 70 per cent of the rise in labour productivity depend on capital investment, 2.6 per cent on organisational measures, 10.9 per cent on the increase in the workers' skills, and the remaining 16.5 per cent on other factors. These figures vary for different industries, but the technical level of production is always in first place.

An analysis of the factors behind labour productivity is extremely important as, provided the data received are reliable, it may serve as a sound foundation for planning. This analysis is not always, however, carried out sufficiently accurately, owing to a shortage of methodological instructions and insufficiently qualified personnel. A more exact determination of the influence of individual factors is required. In particular, the method sometimes used of distinguishing the rise in the technical level of production and the change in its volume and structure is hardly correct, as the second of these factors is, in many instances, dependent on the first.

An analysis of factors makes it possible to determine more accurately the growth of labour productivity in the future by branches of the economy and for the economy as a whole. In each branch, the calculations must be applied to the main type of equipment which it is intended to install: to the capacity of electric power stations and individual generating units, steel plants, blast furnaces and other equipment, oil-processing plants and their individual units, and so on. The calculation must also embrace other factors determining labour productivity: automation, the amount of electric power used per unit of output, new materials, organisational measures, etc. These data may serve as a basis for establishing the growth of labour productivity by branches and sub-branches and then general figures can be arrived at for the economy as a whole. Calculation by branches may reveal the most justified rate of growth.

CHAPTER IX

IMPROVING THE USE OF RAW AND OTHER MATERIALS, FUEL AND FIXED ASSETS

1. DECREASING MATERIAL REQUIREMENTS AND RAISING EFFICIENCY IN THE EXTRACTION OF RAW MATERIALS

One indicator of the development of productive forces is the drop in the expenditure of social labour per unit of output. Thanks to this, the amount of output per worker in material production is continually increasing. Over the last sixty years, the world population has somewhat more than doubled, while the industrial output of the world has increased 20-fold. The figures for the USSR are even more striking. With a population increase of 58 per cent over this period, industrial output has risen 131-fold. From 1950 to 1975, the population increased by 42 per cent, while output by 885 per cent. This increase became possible as a result of decreasing amounts of labour, materials and assets, i.e., expenditure of living and embodied labour per unit of output. We have considered how to reduce the expenditure of living labour per unit of output in the previous chapter. Now let us turn to the question of reducing the expenditure of embodied labour—the amount of material and assets used per unit of output.

One can get some idea of the degree to which the expenditure of living and embodied labour has been falling from data on the change in expenditure per ruble of commodity output in industry. From 1958 to 1975, this expenditure fell by 17 kopecks at constant prices. The share of material expenditure together with depreciation in 1975 constituted more than 80 per cent of all outlays, against 57 per cent in 1932. Wages accounted for 15 per cent as against 35.6 per cent in 1932. The productivity of labour in industry rose by 150 per cent over the years of 1958-1975. These figures show

Table 25

The Structure of the Production Costs of Output (per cent of total)[1]

	1932	1953	1957	1960	1965	1970	1975
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wages plus social insurance allowances	35.6	24.2	20.9	19.3	18.0	16.1	14.6
Material expenditures (raw and other materials, fuel, power)	53.5	68.3	72.6	74.0	73.7	75.6	74.4
Depreciation	3.5	3.7	3.4	3.5	5.0	5.1	6.4
Other expenditures	7.4	3.8	3.1	3.2	3.3	3.2	4.6

that the expenditure of live labour dropped to a considerably greater extent than that of embodied labour.

The proportion of wages plus allowances drops within production costs and that of material expenditures and depreciation grows, while overall production costs fall.

It must be stressed that the drop in the expenditure of live labour *is not at the expense* of an increase in that of embodied labour, meaning their absolute and not their relative magnitudes, even though such an increase does sometimes occur. It is usually a question of the *share* of the expenditures of live and embodied labour, and not of their *magnitude*. With technological progress, absolute material expenditures fall: the expenditure of fuel per kwh of electricity decreases, less metal is used per unit of motor power, and so on. For example, the total expenditure of electricity per ton of primary aluminium dropped from 21,600 kwh in 1966 to 14,700 kwh in 1972, i.e., by 41 per cent.[2] The expenditure of metal per unit of output in the production of motor cars, buses, passenger carriages, compressors and electrical appa-

[1] See *The National Economy of the USSR* for the corresponding years; *The Economics of Industry*, ed. Prof. L. I. Itin, 4th ed., Moscow, 1966, p. 559 (in Russian).

[2] See *The National Economy of the USSR in 1973*, p. 121.

ratus dropped over the same years by 20 to 40 per cent. Material expenditures in other industries also fell: thanks to the more thorough processing of oil, the yield of oil-products per ton of oil has increased; the development of the timber-processing and pulp-and-paper industries has made it possible to improve the use of timber; in the food industry, from 1951 to 1975, the quantity of sunflower seeds required per ton of oil dropped by a third. Along with the drop in the expenditure of materials per unit of output, the characteristics of the products themselves have improved, such as the power of machines, and the efficiency with which materials are used has correspondingly risen. The drop in the expenditure of material per unit of output is an inevitable process reflecting technological progress and opening up new spheres for its application. Thus, it was thanks to the introduction of petrol engines with a reduced weight per unit power (or increased power per unit weight) that aircraft could take off the ground. A wide-spread transition to electric vehicles will become possible once the weight and cost of storage batteries drop sufficiently per unit power.

The overall drop in the amount of material used per unit of output permits, under the influence of science and technology, a change in the share of the more progressive materials among the materials used, and this is what is actually happening. More and more electricity is used in industry from decade to decade. From 1913 to 1975, the amount used increased 418 times, while industrial output for the same period rose 131 times. The increase in the consumption of electricity outstripped that of output as a result of the electrification of industrial processes and the use of electricity both for power and production purposes. In recent years, however, the increase in the consumption of electricity in industry has fallen behind the growth of output. From 1965 to 1975, for example, electricity consumption in industry increased by 88 per cent while industrial output rose by 115 per cent. The correlation in agriculture is different: the consumption of electricity rose by 218 per cent, while the mean output increased from 1961-65 to 1971-75 by only 44 per cent. In transport, the figures were 100 and 88 per cent, respectively. As a result of the more rapid increase in the consumption of electricity in these branches, the

amount of electricity consumed per unit of output for the economy as a whole has risen somewhat in recent years.

Technological progress also leads to a growth in the consumption of chemical products. In many industries, metal and wood are being replaced by plastics, and natural fibres by chemical ones; anti-corrosive coatings, insulating synthetic and polymer materials, and so on are coming into widespread use. The following figures give a general idea of the increase in the consumption of chemical products per unit of output: with an increase in industrial output of 115 per cent from 1965 to 1975, the production of chemical fibres rose by 134 per cent, that of synthetic resins and plastics by 253 per cent, and of basic chemicals by 207 per cent. The production of the most advanced materials, such as glass-plastics and polymerised materials, rose even more rapidly.

The increase in the share of electricity, chemical materials, and aluminium in industrial consumption does not imply an increase in the amount of material used per unit of output. Rather, the substitution of these substances helps reduce the amount of materials used.

The drop in the amount of materials used per unit of output as a whole is reflected in the changes in the USSR's gross product of the extractive and manufacturing industries. It would not be right to compare the growth of the output of the extractive and manufacturing industries at current prices, since the prices for many extracted materials that were previously sold at a loss were brought up to a level ensuring normal profitability for the extractive industry by the 1967 price revision.

A comparison of the growth of output in these industries at constant prices and according to a common method shows that the output of the extractive industry is growing considerably more slowly than that of the manufacturing industry. This means that, with time, more and more finished output is obtained per unit of raw materials, which indicates an improvement in the utilisation of raw materials.

This correlationship between the extractive and manufacturing industries holds for the national economy. The extractive industry with its high assets-worker ratio requires large specific capital investment in output growth and significant expenditures of manpower. Suffice it to say that,

Table 26

Growth of Output in the Extractive and Manufacturing Industries

(1973 as per cent of 1960)

	All industry	Extractive industry	Including the mining industry	Manufacturing industry
At current wholesale prices in each of the two years and using the methods of the plans for corresponding years	325	310	375	326
At constant prices and using a common method	325	213	225	338

although the extractive industry produces only 8.3 per cent of the gross product of all industry, it employs 16 per cent of all the labour force and about 25 per cent of productive fixed assets. This means that the assets-worker ratio in the extractive industry is 250 per cent of that in the manufacturing industry.

Oil extraction has grown faster than the extractive industry as a whole. In 1975, it constituted 332 per cent of the 1960 figure, while gas extraction was 638 per cent and iron-ore mining, 210 per cent. The mining of coal has grown considerably more slowly, reaching in 1975 only 137 per cent of its 1960 level.

These differences are the result of the particularly intensive development of the oil and gas industries in connection with the growth of domestic consumption and exports; the accelerated development of ore mining to bring it up to the level of development of the iron-and-steel industry; and a fall in the share of coal in the country's fuel balance. There are a number of reasons for the high share of the raw material

industries in Soviet industry. The USSR imports only small amounts of raw materials from other countries, while it exports large quantities of oil (up to 30 per cent of the amount extracted), gas, iron and manganese ore (about 17-18 per cent of the amount mined), apatites, potassium salts, timber, etc. What is more, exports are rapidly increasing.

In increasing the export of raw materials to the socialist countries, the USSR is co-operating with them in accordance

Table 27

The Export of Raw Materials from the USSR in 1974

(as per cent of 1960)

Coal	213	Apatites (concentrate)	333
Crude oil	453	Potassium salts	887
Iron ore	284	Ammonium sulphate	514
Manganese ore	154	Logs	413

with the Comprehensive Programme for the Further Extension and Improvement of Co-operation and the Development of Socialist Economic Integration. The export of raw materials to capitalist countries develops foreign trade in exchange for imports of equipment, instruments, materials and also consumer goods from these countries.

Another reason for the high share of the raw material industries in the USSR is irrational use of these materials.

The Soviet Union has considerable opportunities for making better and more economical use of raw materials, while at the same time reducing the amount of materials used per unit of output. This is possible at all stages of extraction and manufacturing, right down to the finished product.

The degree to which the useful mineral is extracted from raw materials must be increased. The measures needed for this differ according to the type of raw material, the particular features of its deposits, and so on. To increase the output of oil, for example, water, air or gas is pumped into the wells to maintain pressure, hot water and steam are used to heat the deposit, etc. It has been calculated that the

oil-yield coefficient can be raised to 0.5, when it actually stands at an average of 0.37. Absolute losses of oil for only 18 fields are estimated at 450 million tons a year.[1] Reducing these losses will be of considerable importance to the national economy, for it can increase the profits of enterprises.

There are also great losses of concomitant petroleum gas. For each ton of oil extracted, there are 150 to 200 m^3 of gas containing benzene, propane and butane, and, once these are drawn off, methane. Much of this concomitant gas is lost, however, and much of it is burned on site. These losses are often explained by the fact that the construction of gas-collecting networks, pumping stations, gas, petrol and other plant is behind and that there is a shortage of spare containers, and so on. There are undoubtedly difficulties, but the opportunities available are far from being fully utilised. Calculations show that any expenditure necessary to store concomitant gas and cut losses will justify itself within a short time.

In the coal industry, considerable additional amounts of coal could be obtained if thin and steep seams were mined. Such coal is often left behind, as it does not prove profitable for the enterprise. From the point of view of the whole economy, however, a certain effect would be obtained from the mining of these "unprofitable" seams. This is why economic measures must be developed as incentives to the enterprise to work thin and steep seams.

In the Urals, where deposits of rich iron ore are limited, there are large deposits of poor titanium magnetites running to thousands of millions of tons. It is only economically efficient to exploit these deposits if all the vanadium, titanium and precious metals (such as the platinum in the Kachkanar ores) contained in them are all recovered. However, hardly any use is made of the waste produced by the Kachkanar combine during the concentration of this ore and titanium concentrate is not recovered at all. A third of the iron ore mined in the Urals contains industrially exploitable quantities of copper and cobalt. The iron-and-steel

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[1] See N. Feitelman, *The Economic Efficiency of Expenditure on the Preparation of the Mineral and Raw-Material Base of the USSR*, p. 226 (in Russian).

plants lack interest in extracting these metals, and these are lost.

There has been some success achieved in the comprehensive use of raw materials containing gold, silver, platinum and other metals of the platinum group, copper, lead and zinc. In every case, however, the economic efficiency of extracting individual components from the raw material must be taken into account. The extraction of many substances required by the country's industry is efficient enough, but there are some for which the demand is small or the extraction of which is very expensive. Expenditure on extracting these substances is not justified. While there have been certain achievements in the recovery of useful minerals, their losses are still great and the elimination of these losses would provide enormous reserves for raising the efficiency of social production. The amounts of minerals contained in the dumps and slag heaps of some ferrous and non-ferrous metal plants are considerable and sometimes differ only slightly from those found in deposits that are exploited. In many instances, the extraction of the useful components from slag is much cheaper than obtaining them from ore. The slag heaps of some non-ferrous metal plants contain so many useful components that they have come to be called "surface deposits of ores".

It is especially inadmissible that pollutant by-products are not used. For example, not all ferrous and non-ferrous metal plants, oil-processing and chemical industry enterprises and electric power stations have equipment to trap the waste sulphur gases they give out. These are released into the atmosphere to poison the environment. At the same time, material losses are also great: 16-18 million tons of sulphurous anhydride, from which 20-25 million tons of sulphuric acid could be made, are released into the atmosphere each year. According to the State Design Institute for the Chemical Industry, the cost of producing a ton of sulphuric acid from sulphurous anhydride is half that of producing it from natural sulphur or sulphur pyrite, while the capital investment is 20-40 per cent lower. Sulphur gases could provide up to half the total output of sulphuric acid. The same can be said of the slag and ash from thermal electric power stations, of which in 1975 there were 100 mil-

lion tons. The total expenditure on storing this enormous quantity of waste exceeds 100 million rubles a year and thousands of hectares of land are needed for the slag heaps, whereas, a considerable effect could be obtained from using ash and slag in the production of building materials—7-15 rubles per ton of utilised waste.

2. IMPROVING THE UTILISATION OF MATERIALS

In order to save raw materials, they must be more thoroughly processed and used to manufacture finished products of higher quality. Oil and gas, for example, should not be used as fuel, but as chemical raw materials. D. I. Mendeleyev himself said that to use oil as fuel was tantamount to burning money.

Saving raw materials and making better use of them depend to a considerable degree on improvements in techniques. In order to reduce the expenditure of fuel, for example, electric power stations must use powerful plant with high steam temperature and pressure, and small-capacity, uneconomical generating units must be phased out. This, in turn, requires development of the power transmission network supplying the consumers with cheap electricity from large district electric power stations. Measures such as setting up centralised heating systems for cities and boilers using exhaust heat, etc. could also help save raw materials.

According to A. Probst, exhaust-heat boilers in the steel industry alone could bring savings of 12-14 million tons of conventional fuel per annum.

Attached to one of the blast furnaces of the Cherepovets iron-and-steel plant there is an electric power station using the surplus pressure of the furnace gas which usually has to be reduced by special equipment. This electric power station can produce up to 40 million kwh of cheap electricity a year. Considerable economies could also be made in the use of fuel by improving and replacing old and obsolete boiler installations by centralised heating systems in the non-productive sphere (housing, municipal services, and so on). Outlays per ton of fuel saved are also considerably less than those on extracted fuel.

In order to cut down the waste of ferrous metals in engineering, metal-cutting must, wherever feasible, be replaced by stamping, for which purpose more rolled sheet must be produced (more than 50 per cent of all rolled products instead of the present 35 per cent), the proportion of precision castings increased and the casting allowances reduced. The iron-and-steel industry has not yet sufficiently developed its output of curved and other shaped castings, which would reduce the need for engineering plants to process the castings they receive from the iron-and-steel plants. Centralised production of the needed shaped casting in metallurgical plants is more efficient. An increase in the production of high-quality and special steels and the smelting of high-quality cast iron in induction furnaces are of considerable importance, for this helps extend the length of service of metal parts and units, thus reducing the demand for metal. Rational use of ferrous metals is tantamount to a relative cut-back in the mining of the material. Suffice it to say that to produce the 15 million tons of metal which go to waste at the engineering plants, 25-30 million tons of iron ore, coal, flux and other materials have to be mined.

Considerable savings might be made in timber felling if a large number of finished products were made from it. At the beginning of the Ninth Five-Year Plan, about 300 million cubic metres of commercial timber were transported from their place of origin. Over the last ten years, commercial timber felling has risen by only 15 per cent which is explained by improved utilisation of timber: the value of finished products per cubic metre of timber had risen from 19.3 rubles in 1950 to 29.9 rubles in 1960 and 43 rubles in 1970. All the same, the unused waste from timber is still great. Tens of millions of cubic metres of timber are left in the forests in the form of branches, stumps and short-length trunks; much timber is lost during transportation, floating and so on; the waste in the form of bark, shavings, chips and blocks is considerable.

In the Tenth Five-Year Plan period, a significant increase is envisaged in the output of finished products from timber. To this end, considerable resources have been allocated for the development of the timber-processing and pulp-and-paper industries. Economic calculations show that this in-

vestment will yield returns much more quickly than is usually expected, particularly considering that, without an increase in the yield of final product, considerably more timber would have to be felled, involving its transportation to the sites where it undergoes preliminary processing, which would entail large additional capital investment.

There are also major reserves in the production and utilisation of agricultural produce. The consumer could receive far more vegetable and animal products if grain losses during harvesting, transportation to warehouses and elevators and sometimes in warehouses too were eliminated. The maintenance and feeding of cattle during transportation to meat-packing factories could be improved too, thus preventing a drop in live weight. There have been instances both in the Far East and in the Baltic republics, when fishing boats could not be unloaded because the capacities of fish-canning factories and refrigeration facilities were insufficient and sometimes because of lack of dispatch. The Party and the government show considerable concern over the development of agriculture, to which vast sums are allocated, and negligence with respect to agricultural produce is inadmissible.

There are several reasons for the losses of agricultural produce and foodstuffs. One of these is that the warehouses and also the manufacturing industry are not developed enough to handle the vast volume of agricultural produce.

In order to eliminate these shortcomings, during the five years from 1971 to 1975, elevators with a capacity of 16.6 million tons were built, against 8.7 million tons in the Eighth Five-Year Plan period (the Ninth Five-Year Plan envisaged 24.1 million tons over the five years), and grain stores of 30.4 million tons. The Party and the government have adopted in 1975 a decision to build grain stores with a capacity of 40 million tons, including elevators of 34 million tons, during the years 1975-1980. The capacity of the food industry will be raised to cope with the growing volume of agricultural produce. All-round development of agriculture and of ancillary enterprises is also essential. By Party decisions agro-industrial complexes are to be set up—at the level of the lowest production units

and on the regional, district, republic and, finally, the national scale.

This involves the preliminary processing and storage of the produce of collective and state farms, the development of industry, transportation and storage of agricultural produce at the local level, and finally co-ordination of the development of agriculture and the industries that process its output and provide it with the necessary equipment (machinery, fertilisers, and so on) on the national scale.

In the Central Committee's report to the 25th CPSU Congress, L. I. Brezhnev said: "Also it must not be ignored that in the coming period we shall have to allocate more resources for speeding up the development of transport, communications and the system of material supplies—of all that is called the infrastructure. In the past we simply could not give due attention to many of these spheres, in particular, to the construction of roads and storage facilities. We shall now have to engage in this work and do it seriously."[1]

Another reason for the losses in agriculture is the shortage of hands during harvesting, which makes it necessary to draw assistance from the towns and send factory and office workers and students to help with the harvest (potatoes, vegetables and fruit). The urban dwellers do not always have the necessary skills for the work. The solution to this problem lies in mechanisation, and also, possibly, in stimulating the material interest of collective farmers and state-farm workers themselves.

One major condition for saving materials is to improve their quality, strength and length of service. Improving the quality of agricultural produce, for example, makes it possible to reduce its requirements in achieving the effect wanted and providing the consumer with the necessary number of calories in milk with a higher fat content, better-quality meat or sugar-beet with a higher sugar content.

Metals can be saved through tempering, compacting the working surface, shot-blasting, the use of protective plastics or paint coatings, and so on.

[1] *Report of the CPSU Central Committee and the Immediate Tasks of the Party in Home and Foreign Policy*, 25th Congress of the CPSU, Moscow, 1976, p. 52.

The length of service of wooden products can be extended by impregnation and painting. Increased durability is also obtained through the use of hybrid materials that combine the qualities of more than one material.

Higher quality, reliability and durability of a product must be economically efficient for both the producer and the consumer. Extra money is required to turn out products of higher quality, and so they must be correspondingly priced as an incentive to the enterprise to produce them. On the other hand, the price of higher-quality products must not be high to scare away the consumer. In both instances, the interests of the national economy might suffer. This is why it is important, in planning quality and prices, to determine the saving that the high-quality products will yield and at what cost.

In many cases, the production of higher-quality output is more profitable for the national economy, regardless of higher prices and outlays. For example, the manufacture of stereoregular synthetic rubbers of a quality far higher than that of previous types (sodium-butadiene and other rubbers) comes more expensive and requires larger capital investment. Tyres made from these types of rubber, however, cover 20 per cent or more longer distances, which is tantamount to an increase in the output of tyres. The capital investment in setting up a plant to produce such rubbers is recouped in three to four years. Another example is alloyed steels. These are more expensive than the usual carbon steel, but provide longer service and this justifies their use, especially in the manufacture of parts and other units that have to stand up to friction or work under heavy strains.

There is no shortage of such examples. In all cases the feasibility of using materials of higher quality must be economically justified.

High reliability is essential in many instances regardless of the savings it gives or expenditure it entails: for example, where the safety of trains, cars, aircraft or the work of electric power stations providing electricity to enterprises and consumers or, finally, defence are concerned. In other cases, an increase in reliability can be determined by economic considerations, for instance by

comparing the increased cost of the part or unit of greater reliability with the saving resulting from less frequent replacement. The durability of individual parts and units of a device, machine-tool or a transport vehicle must, of course, correspond to that of the whole, otherwise extra expenditure is involved, since some of the expenditure on raising the durability of an individual part above that of the whole will not be worthwhile.

Some of the ways of saving materials are to improve the design of the final product; cut surplus reserves of durability; reduce weight by using higher-quality metals, and replace metal goods with plastics and so on. According to available data, some types of goods, such as motor vehicles, railway carriages, machine-tools and other machines, are often 20-25 per cent heavier per unit power, load carrying capacity, etc. than similar items abroad.

The use of recycled raw materials can have a significant effect. In the Soviet Union, there is a relatively high use of recycled material in ferrous and non-ferrous metallurgy. The metal invested in the country in machines, rails, rolling stock, ships and various constructions at the present time amount to almost 1,000 million tons. Depreciation scrap constitutes about 4 per cent of this, i.e., approaches 40 million tons a year, while all scrap together amounts to 70 million tons a year. Adequate use is made of non-ferrous scrap, though there is room for improvement here, too. At the same time, other types of recycled materials such as rubber, glass and paper, are not yet used sufficiently. The use of recycled materials and the development of recycling methods will also help reduce the amount of waste, which in turn will cut down on pollution of the environment. In recent years, this has become an increasingy urgent task owing to the progressing growth in the amount of waste both in production and consumption.

3. REDUCING THE ASSETS-OUTPUT RATIO

The steady growth in production on which the development of socialist society is based, the increase in the people's standard of living and the construction of the mate-

rial and technical base of communism require a growth in productive assets, both fixed and circulating. We have already considered the significance of circulating assets, consisting of raw and other materials, fuel and energy, in our analysis of the reduction in the amount of material consumed per unit of output, saving in which is the main factor of a reduction in the specific expenditure of circulating assets. If output is increased for a given amount of circulating assets, the rate of turnover of the latter is accelerated. This acceleration might not, however, be connected with saving on material expenditure, but may result from a cut-back in stocks, more precise organisation of the production and circulation processes, and so on.

A cut in the expenditure of fixed productive assets per unit of output, or in the assets-output ratio, results from an increase in output with the assets remaining the same. Fixed productive assests are a value factor that measures, in monetary terms, the quantity of means of labour (buildings and structures, machinery, equipment and instruments, transportation facilities, etc.). This amount of assets and their fluctuations were considered in Chapter V. Now let us look at their relationship to the volume of output. The fact is that, with a given amount of fixed productive assets, the volume of output can be greater or smaller, depending on the quality of the means of labour, their productivity and the degree to which they are utilised. These differences are defined as an assets-output ratio, the output being expressed in gross terms, while the return on assets is the ratio of the gross product to assets. The direct or inverse relation of fixed and circulating assets to the net product is also called the assets-output or output-assets ratio, respectively.

In 1970, the assets-output ratio of the social product, with fixed productive assets of 422,000 million rubles (on January 1) and a gross social product of 643,000 million rubles, constituted $\frac{422}{643} = 66$ kopecks per ruble of the social product, while the return on assets was $\frac{643}{422} = 1.52$ rubles per ruble of fixed assets. In 1975, following the revaluation of fixed productive assets, these consisted of 741,000 mil-

lion rubles (as of January 1), while the gross social product was 862,400 million rubles. Thus the assets-output ratio had risen to 86 kopecks per ruble, while the output-assets ratio had dropped to 1.16 rubles, though this was to a large extent the result of price changes during the revaluation.

The increase in the assets-output ratio over the five years of 20 kopecks per ruble of the social product, or of four kopecks a year on average, was compensated for by a rise in the productivity of social labour by 23 per cent and a drop in the production costs of the gross social product. This can be judged from the drop in the production costs of the commodity output of industry by 3.1 kopecks per ruble of output over the five years, or by 0.62 kopecks a year, and from that in construction by 2.4 kopecks, or 0.5 kopecks a year. If the average drop in the production costs of the gross social product is taken as 0.6 kopecks per ruble a year, savings in current costs cover the growth of the assets-output ratio of five kopecks per ruble in the course of 6.7 years, or efficiency is 15 per cent a year.

It is interesting to compare the growth of the national income with that of fixed productive assets.

At one time in the past the growth of the national income of the USSR was three times higher than that of fixed productive assets. From 1913 to 1940, for example, produced national income rose by 430 per cent, while fixed productive assets rose by only 40 per cent. Later the balance changed: in 1960 the national income was 2.3 times higher than its 1950 level, while fixed productive assets were 2.5 times as great. This divergence became even more pronounced during the 1960s and the early 1970s: the national income rose by 150 per cent from 1960 to 1975, while the assets rose by 266 per cent. During the 1960s, there was a drop in the return on assets, defined as the ratio of the national income to assets (see Table 28).

In the first half of the 1960s there was a significant drop in the return on assets. It came to a halt during the second half of the decade and then picked up again during the early 1970s.

There are great opportunities in this country to make more efficient use of productive assets and raise the return

Return on Productive

	1959	1960	1961	1962	1963	1964	1965
Fixed productive assets at the beginning of the year, thousand million rubles	162	174	190	209	230	254	278
Circulating assets in the form of stocks of goods and materials at the beginning of the year, thousand million rubles	57	66	71	78	86	93	103
The sum of fixed and circulating productive assets, thousand million rubles	219	240	261	287	316	327	381
National income for the year, thousand million rubles . .	135	145	153	165	169	181	194
National income per 1 ruble of fixed productive assets, kopecks	83.0	83.2	80.5	79.0	73.5	71.3	69.5
National income per 1 ruble of fixed and circulating productive assets, kopecks	61.6	60.4	58.6	57.5	53.5	52.1	50.9

[1] According to data from the yearbooks *The National Economy of the USSR 1972*, pp. 60, 531 and 702; *The USSR in Figures for 1973*, pp. 27 and 175.
* Fixed productive assets after the revaluation. At former prices fixed as culating assets to 722,000 million rubles. Correspondingly, the return on as (circulating assets include trade, but not collective farms).

Table 28

Assets in the USSR[1]

1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
312	337	363	393	422	461	501	623*	675	741
108	117	131	142	149	163	175	187*	206	221
420	454	494	533	571	624	676	810	881	962
207	226	244	262	290	305	314	338	354	362
66.4	67.1	67.2	66.6	68.7	66.1	62.6	54.1	51.9	48.9
49.3	49.8	49.4	49.1	50.8	48.9	46.4	41.6	39.8	37.6

and *The USSR in Figures*. See, e. g., *Tte National Economy of the USSR in*

sets amounted to about 535,000 million rubles, and the sum of fixed and cir-
sets for 1973 would be 63.1 and 46.8 kopecks, i. e., higher than in 1972

on capital, i.e., reduce the assets-output ratio of production.

It is of primary importance to ensure fulfilment and overfulfilment of the production plan and increase the volume

Table 29

Gross Product and Fixed Productive Assets in Industry (1960 = 100)

Industry	1965		1970		1975	
	Gross product	Fixed prod. assets	Gross product	Fixed prod. assets	Gross product	Fixed prod. assets
All industry	151	168	227	256	323	387
Electricity generation	178	173	274	284	384	400
Fuel	137	142	181	202	240	289
Iron-and-steel	147	165	194	251	247	356
Chemical and petro-chemical	195	234	349	415	572	656
Engineering and metal-processing	179	173	313	278	541	445
Timber, wood-processing, pulp-and-paper	128	155	168	222	211	326
Building materials	153	173	229	264	321	404
Light	113	148	171	232	213	329
Food	142	157	189	228	239	326

of output. At the same time, for a number of years recently the productive assets of industry as a whole and by branches have been growing faster than the gross product (see Table 29).

The increase in the assets-output ratio for industry as a whole depends partly on changes in its structure and in the more rapid development of branches with a high assets-output ratio. With an average assets-output ratio in industry of about 63 kopecks per 1 ruble of gross product (industrial productive assets as of January 1, 1975 amounted to 353,000 million rubles and the gross product in the same year to 558,300 million rubles), in the power industry the assets-output ratio was more than 4 rubles

15 kopecks; in the fuel industry it was 1.5 rubles; 0.9 rubles in the chemical industry; 1 ruble in the building-materials industry; about 0.5 rubles in engineering; 0.2 rubles in light industry, and 0.3 rubles in the food industry.[1] At the same time, the share of the power industry, the chemical and petro-chemical industries, engineering and metal-processing, and the building-materials industry in the gross industrial product rose from 26.9 to 41.6 per cent between 1960 and 1975, while that of the light and food industries fell from 47.9 to 33.9 per cent.[2]

This is not all, however, particularly since the share of certain capital-intensive industries, such as the fuel industry, actually fell. The fact is that, in almost all branches of industry (with the exception of engineering and metal-processing where, however, price rises were not always justified), fixed productive assets are growing faster than the gross product.

In order for the assets-output ratio to drop in every industry, production must grow more rapidly than assets. This, in turn, requires fuller utilisation of the means of production by increasing the time equipment is in operation or by raising machining speeds, reducing the utilisation factor of the effective volume of blast furnaces, raising the average daily output of steel per square metre of hearth area in open-hearth furnaces, etc. All this depends largely on the workers' skills and the quality of the equipment available, and also on improved organisation of production, the introduction of time-tables, supplies being received on time, fulfilment of contracts on mutual deliveries and so on.

A growth of the assets-output ratio is justified when existing equipment is replaced by expensive, complex and productive machinery. In this case, as a rule, the current production costs fall and the savings cover the increase in the assets-output ratio. This ratio also rises if new technology is introduced slowly. The question is to what degree such causes were operational during the period under con-

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[1] See *Intensification and Reserves in the Economy*, p. 178 (in Russian).

[2] See *The National Economy of the USSR in 1975*, p. 197.

sideration and how they affected the growth of the assets-output ratio.

Manual labour was replaced by machinery in the main workshops of industrial enterprises at an earlier stage. At the present time, with the acceleration of scientific and technological progress, obsolete technology is being replaced by more progressive types. The broad-scale application of new technology is itself capable of engendering a rise in the assets-output ratio. There are cases, however, when the additional cost of new machinery used in the main workshops is not covered by higher productivity. This results from unjustified price rises introduced by the producers after minor changes and improvements in machinery that only slightly increase its productivity. There are also instances when the productivity of a new, more expensive piece of machinery is excessively great and cannot be fully utilised. Sometimes the running-in period and even the setting-up and putting into operation of new technology is too long (stocks of equipment not yet installed increase), which results from the enterprise working unsatisfactorily.

Special mention should be made of the fact that, in the auxiliary and service shops of enterprises (transportation, repairs, and so on), where manual labour is still in use, mechanisation leads inevitably to a rise in the assets-output ratio since investment, necessary by itself in these fields, does not give an increase in output.

In this way, the assets-output ratio rises due to both objective and subjective factors, and the task consists in eliminating the latter and thus bringing into operation a major reserve for raising the efficiency of production.

Solving this problem of reducing the assets-output ratio depends on improved utilisation of both fixed and circulating assets. A reduction in the expenditure of raw and other materials and fuel, in accordance with progressive standards and progressive techniques, elimination of bottle-necks in production, an improvement in the organisation of the production process, application of time-tables for the loading of machinery and the use of material and moral incentives: these are all ways of reducing the assets-

output ratio. They are primarily the concern of the enterprises themselves, but also of the economic management and planning agencies.

Another way of reducing the assets-output ratio is to increase the productive capacity of industry mainly by modernising and expanding existing enterprises rather than building new ones. Modernisation takes up less investment and leads to better utilisation of means of labour and to a drop in the assets-output ratio.

The share of capital investment in modernisation, expansion and retooling of existing enterprises in the overall volume of capital investment in Soviet industry was 55 per cent in 1960, 61 per cent in 1965, 58 per cent in 1970 and 67 per cent in 1975 (data broken down by branches of industry are given in the chapter on capital investment).

4. IMPROVING THE UTILISATION OF PRODUCTIVE PLANT

A reduction in the assets-output ratio requires fuller utilisation of the productive plant of enterprises.

There are several types of productive plant reserves. These can be divided into two groups:

(a) reserves that are planned and essential for the normal operation and development of the enterprise, and

(b) unplanned reserves that result from imbalances and unsatisfactory operation of enterprises.

The first group includes reserves of plant capacity necessary for seasonal production, seasonal and other regular fluctuations in output, reserves for insurance and emergency should production be increased sharply and expansion reserves for the second and third stages of the development of the enterprise.[1]

Unplanned reserves in the form of unutilised plant arise when there are bottle-necks limiting the productive capacity of the entire enterprise, as a result of which the capacity of individual sectors or even of whole workshops cannot be used to the full. Unutilised plant capacity also

[1] See Y. B. Kvasha, *Reserves of Plant Capacity*, Moscow, 1971 (in Russian).

arises owing to delays in deliveries, flaws in the organisation of production and labour, lack of manpower, high labour turnover, and so on.

In his book *Reserves of Plant Capacity*, Y. B. Kvasha considers certain data for calculating the amount of reserves required. This amount might be justified partially in economic terms and partially in terms of production and technical reserves. Calculations of the capacity reserves of electric power stations show that losses due to idle time of fixed assets per ruble of their value are only a tenth of the possible losses arising from a shortage of electricity in industry, also per ruble of fixed assets. It has been calculated that reserves in electric power systems must constitute 1.5 per cent of installed capacity.

Effective plant capacity in other industries can be determined in the same way, such as that of the sugar industry, taking account of the short period of time during which sugar-beet must be processed if losses of sugar content are to be kept to a minimum.

Reserves for insurance and emergencies, which are of national and particularly of defence significance, depend on the current standards and funds available for these purposes.

The size of reserves for the construction of second and third stages can be determined by comparing capital investment advanced for setting up these reserves (such as foundations, walls and communications on the assumption that the enterprise will be expanded) with the amount of additional capital investment that would be required to add second and third stages if no advance was made. In absolute terms, this additional capital investment is greater than the original (since, for example, it is cheaper to put up a building for all the three stages, than to build each stage separately). Otherwise there would be no question of advance investment. However, since the advance capital investment is "frozen" until the second and third stages come into operation, it must be discounted and reduced to the time when the additional capital investment comes into operation or the additional capital investment must be discounted and reduced to the time when the capital investment was originally advanced. The results of

both these calculations might differ, but the second method is conventionally used. Discounting may show that advancing capital is unprofitable, and this is why calculations of the efficiency of setting up construction reserves are essential.

As far as unplanned reserves are concerned, these are the result of construction not being completed on time: the plant of auxiliary workshops often lagging behind that of the main ones; sometimes changes in the system of raw material and fuel supply from that originally envisaged; flaws in the organisation of production, supplies and sales; sales difficulties owing to poor quality of output, lack of correspondence with the product range, shortage of manpower, and so on.

At the same time, in a number of industries, plant capacity utilisation in the USSR is better than in the USA. On the whole, for example, the utilisation of the mean annual installed capacity of electric power stations is higher in

Table 30

The Productive Capacities of Blast Furnaces and the Output of Cast Iron

	1950	1960	1970	1974
USSR				
Effective volume of blast furnaces, thousand m^3 . .	58.8	110.2	150.0	167.6
Output of cast iron, million tons	19.2	46.8	85.9	99.9
USA				
Effective volume of blast furnaces, thousand m^3 . .	218.7	254.3	252.6	240.4
Output of cast iron, million tons	59.4	61.1	83.3	87.0

the USSR than in the USA, although in recent years the gap has been closing owing to an absolute drop in both countries.

This drop in the USSR is partially due to the introduction of new large electric power station capacities.

Reference is often made to a drop in the shift coefficient of workers in engineering as an indicator of insufficient utilisation of productive plant capacity. On average for the whole of industry, the shift coefficient is approximately 1.4-1.5, while in engineering it is 1.3-1.35.

When considering the shift coefficient and possibilities for increasing it, account must be taken alove all of the existence of a number of types of production which, by their very nature, require continuous operation, such as electric power stations, metallurgy, the chemical industry and railway transport. These should also include seasonal industries such as the sugar and canning industries, in which continuous operation is particularly efficient, making it possible to preserve fully the quality of the processed product. In all other industries, in which production is not continuous, not only the economic, but also the socio-economic significance of raising the shift coefficient must be taken into account. In this respect, night shift work is undesirable, especially for women, and it should only be practiced in critical cases. For the worker, even working the second shift is less convenient and less desirable than the first, but in this case production requirements must be put first. References to a shortage of manpower for raising the shift coefficient, to difficulties in finding new workers, supplying them with housing and social amenities are in the majority of cases unjustified, as almost all enterprises have considerable internal reserves of manpower which could be switched on to an additional shift, given proper organisation of labour, incentives and training.

The main point here is somewhat different, however, as correctly noted by Y. B. Kvasha: the shift coefficient of workers does not reflect the degree to which machinery is utilised. The shift coefficient of the main equipment in engineering and in the textile industry substantially exceeds that of workers. Considering that industries with continuous work account for almost a half of all fixed assets, the shift coefficient for machinery in all industry comes out well above 2. This means that the possible effect of increasing the shift coefficient is less than is usually be-

lieved. During the Tenth Five-Year-Plan period, the shift coefficient will rise in engineering by 20-30 per cent.

There are considerable reserves of uninstalled equipment. The main reason for this is a lag in construction but, at the same time, there are large productive areas in industry standing unoccupied. This gap is the result of insufficiently balanced co-ordination of a number of economic growth factors and, above all, of the slow rate of construction work.

Neither should it be forgotten that reserves of productive plant capacity are required for the introduction of new technology, for an uninterrupted growth of production, for carrying out repairs, for economic manoeuvre and, finally, for unpredictable emergencies. The intensity of railway operations may serve as an example of the fact that, from this point of view, the overstraining of fixed assets might be undesirable. The average density of freight traffic on the railways has increased 22-fold during the years of Soviet power in comparison with 1913, while in most developed capitalist countries the increase over the same period has been 50-100 per sent. In 1975, the density of freight traffic on the railways in the USSR was approaching 22 million ton kilometres per kilometre of operating line, which is six times as high as in the USA, 14 times as high as in Britain and 10 times as high as in France and West Germany. Any further increase in traffic density might impede the flexibility of the railway network, which would have an adverse effect on the economy, on the development of industry and agriculture, on supplies to industry and consumer, and so on, to say nothing of the conditions necessary for dealing with freight if there were an unexpectedly rapid growth.

The drop in the assets-output ratio (and increase in the return on assets) should not be at the expense of planned reserves of productive plant capacity.

Planned reserves of productive plant capacity are essential to ensure the normal course of reproduction. These reserves should neither be excessively expanded nor contracted. Economic calculations of investment in creating reserve capacity and the losses in cases when these reserves prove insufficient will show their optimal size.

CHAPTER X

INDUSTRY AS THE LEADING BRANCH OF THE NATIONAL ECONOMY AND ITS CONTEMPORARY FORMS OF DEVELOPMENT

1. THE ROLE OF INDUSTRY IN THE NATIONAL ECONOMY AND ITS MAIN TASKS

The leading place in the developed socialist economy belongs to industry. It employs 34 million people, or a third of the labour force engaged in material production. While increasing the volume of production from year to year, industry demands manpower and plays a major role in providing full employment. Industry accounts for almost two-thirds of the gross social product and half the national income of the USSR. It provides its products both for productive consumption in the national economy and for the people's consumption, satisfying demand and forming the material base for the growth of the population's welfare. Industry ensures the economic independence and the defence potential of the country. Its role in creating the conditions for further development of production is of extreme importance. It is in industry that technological progress, new means of production and new methods originate and spread to other branches.

Industry creates the conditions for the growth of the productivity of social labour throughout the national economy, for the increase in the economic efficiency of production and for progressive changes in the branch structure of the economy. Industry's role in the socialist modernisation of the country formed the basis for industrialisation in the USSR, for the creation and development of large-scale industry, primarily heavy industry, capable of equipping all branches of the economy with capital goods of the most advanced types.

The industrialisation policy led to a rapid growth of industrial output. By 1940 it was already 670 per cent of its 1913 level, while it was 40 times greater in 1960, 92 times in 1970 and 131 times in 1975. Industrial output in 1913 constituted 12.5 per cent of the US level, while in 1950 it was 30 per cent and in 1975 exceeded 80 per cent.

The rate of growth of industrial production for 1971-1975 was 7.5 per cent, which was higher than in the majority of developed capitalist countries. This extremely rapid development contributed to the fact that the Soviet Union now produces a fifth of the industrial output of the whole world.

The share of industry in the economy of the USSR rose particularly rapidly during the industrialisation period, during the first five-year plans and also after the Second World War. In 1913 industry accounted for about a third of the gross social product of the country, while the figure was about a half in 1940, 62.2 per cent in 1960, 63.9 per cent in 1970 and 64.7 per cent in 1975.

During the period of developed socialism, the share of industry in the national economy is holding steady at about 64 per cent, while the development of the other branches of the economy, such as agriculture, construction and trade, is speeding up. In spite of this acceleration, however, the share of industry is not falling. The advance of the other branches of the economy would be impossible were it not for the development of industry. This is why, with the share of industry in the social product stabilised, the production and application of the advanced technology throughout the national economy still depends upon it, as does the increase in the efficiency of social production.

The development and production of new technology requires large-scale investment that grows by the year. This underlines the need for substantiating and selecting the most efficient lines of scientific and technological progress, for pursuing a single technological policy in order to achieve the highest technical level in the world, corresponding to the socialist system of economy and the requirements for constructing the material and technical base of communism.

Industry must provide everything necessary for the main lines of technological progress: further electrification of

the economy; automation and mechanisation of production, particularly of heavy labour-intensive operations, new and better materials, including synthetic ones, and the introduction of advanced technology, i.e., everything that helps to raise the efficiency of social production and the economy to grow rapidly. For these important targets to be achieved, an acceleration of technological progress is needed in industry itself, as is improvement of its production.

This is a difficult but not insurmountable task. The aim now is not to increase the number of workers, as it was during the first years of industrialisation when there was a large inflow of untrained workers from other branches of the economy. Industry has plenty of internal reserves of manpower which could be used if production were better organised, and references to shortages of workers are often unjustified. Furthermore, it is now not so much a matter of the number of workers, as of the level of training of each worker. The present-day worker stands incomparably higher in terms of knowledge and culture than his counterpart half a century ago. As a rule, he has a secondary education and a broad social outlook. The skills, knowledge and experience of the worker come to the fore along with the advance of technological progress. At the same time, while speaking of the decreasing importance of the numbers of workers, certain demographic factors that limit the inflow of workers should be mentioned. During the Eighth and Ninth Five-Year-Plan periods the annual increase in production personnel in industry dropped from 2.8 to 1.5 per cent.

In these circumstances, industry is called upon to improve the utilisation of fixed assets and do everything possible to raise the productivity of labour.

2. THE BALANCE BETWEEN GROUPS A AND B IN INDUSTRY

The balance between groups A and B is of considerable importance in the growth of industry and its role in the national economy. This issue is usually considered in the light of the law of the preferential growth of output of means of production (capital goods). In actual fact, groups A and B in industry and departments I and II of the na-

tional economy are not, of course, identical. First of all, industry is only a part of the economy, which means that groups A and B constitute only parts of departments I and II. Department I includes not only the industry in Group A (mainly), but also the production of agricultural raw materials for the light and food industries, freight transport, a substantial part of construction and communications. Furthermore, many Group A enterprises produce consumer goods, the output of which has been growing fairly rapidly in recent years. Heavy industry enterprises produce, for example, cars and motorcycles, radios and TV sets, refrigerators and washing machines. On the other hand, a significant proportion of the output of Group B enterprises is made up of capital goods: these include industrial fabrics, fats for reprocessing, for example, into soap, flour for bakeries and so on. Unfortunately, state statistics does not yet give a detailed assessment of the balance between the two sectors, as we are here dealing not only with industry, of course, but with the entire economy.

During the years of Soviet power, in the course of industrialisation, there has been a systematic increase in the share of heavy industry—Group A—in industrial output. In 1913, its share was 35 per cent, while it was 39.5 in 1928, 61.2 in 1940, 68.8 in 1950, 72.5 in 1960 and 74.4 per cent in 1968. From 1968 onwards, as a result of measures taken to raise the population's level of consumption, the share of Group A began to contract somewhat and in 1971 it stood at 73.4 per cent. Later, however, partly owing to the bad harvests in 1971 and particularly in 1972, the rate of growth of Group B output again began to lag behind that of Group A, standing at 6.0 and 6.8 per cent, respectively, in 1971, 5.7 and 6.8 per cent in 1972 and 5.9 and 8.2 per cent in 1973. From 1970 to 1975, Group A output rose by 46 per cent, and Group B output by 37 per cent. The share of Group B in 1975 was 26 per cent. During the Tenth Five-Year-Plan period, industry's output of consumer goods will rise by 32 per cent. It was stressed at the 25th Congress that the situation in a number of Group B industries and in the service industry is not satisfactory, which is largely explained by the lack of concern on the part of central planning and management organs, ministries and all those who did

not fulfil their obligations concerning the introduction of new plant on time and the supply of equipment and raw materials.

The question arises as to whether, in the future, the share of Department I will rise or, speaking of industry, at least that of Group A, and whether this balance is being co-ordinated with the task of raising the level of national consumption.

From the beginning of the 1960s, some Soviet economists have been voicing the view that a growth in the share of Department I is not a law and that such an increase conflicts with the target of raising the population's standard of living. Reference is also made to the fact that, in the developed capitalist countries, and above all in the USA, the share of the production of consumer goods is growing. We cannot agree with all this.

The goal of socialist production is, of course, consumption. In order to increase the production of consumer goods, however, the production of capital goods must be developed, thus raising its share.

This process has been going on right from the initial stages of the development of society, when people realised the expediency of spending a proportion of social labour not directly to obtain material goods, but to create implements of labour to ease labour and raise its productivity. At first this was only a small proportion, as the implements of labour were themselves primitive and did not require any large expenditure. With the transition to higher stages of social development and technological progress, however, the implements of labour became more complex, rendering increasing assistance to labour and requiring an ever increasing proportion of the expenditure of social labour for their production. As a consequence, the share of Department I gradually increased.

The balance between expenditure on the production of consumer goods and that on the production of capital goods is still changing in the same direction at the present stage in the development of productive forces.

The essence of technological progress consists in the fact that improvement of implements of labour allows a given number of workers to operate ever increasing

capacities of means of production, thus raising output. That is the result of the increase in assets-worker and capacity-worker ratios (the two must be distinguished because the most productive means of labour are not always the most expensive).

An increase in the assets-worker ratio means that the production of capital goods, i.e., the output of Department I, is rising faster than the number of workers. For simplicity, let us assume that assets (and the assets-worker ratio) grow while the number of workers in material production remains constant. In this case, the value of the net product produced (the national income) does not increase, since it is proportional to the expenditure of living labour, which remains at the same level. But the capacity of the means of production operated by living labour increases, and therefore the number of units of output produced also rises. The physical volume of production as a whole, at constant prices, grows by virtue of Department I: this is essential for increasing the assets-worker ratio. In relative terms, the share of Department II output falls, while that of Department I will rise. Thus, technological progress in itself leads to an increase in the share of Department I.

Reality changes this balance somewhat. We proceeded from the oversimplification that the number of workers in material production remains unchanged and that the consumption level does not grow. In fact, both the number of workers and the level of per capita consumption rise. Accordingly, a part of the increase in output consists of consumer goods, which necessitates a corresponding increase in production in Department II. At the same time, socialist society ensures an objective balance between the growth of consumption and that of labour productivity: the increase in labour productivity, in so far as it is determined by the rising capacity-worker and assets-worker ratio, must outstrip that of wages, and this is one of the conditions for a high rate of expansion of reproduction. This also exerts an effect on the priority growth of Department I.

Furthermore, the increase in the welfare and culture of the people depends to a considerable extent on the development of production in Department I. The output of the

construction industry (Department I) includes the building of housing, schools and other educational establishments, scientific institutions, theatres, museums, sanatoria, roads and transport facilities. Department I also includes a substantial proportion of the agricultural output that is further processed in industry.

The role of Department I in raising the population's standard of living will increase even more in the future, as broad and extensive measures will be required to protect the environment, purify the atmosphere and water and so on.

Finally, the development of the production of consumer goods requires means of production designed for this sector—machines and machine-tools and other equipment, materials (metals, timber, plastics and synthetic fibres), and raw materials of agricultural origin. To produce these, the output of industrial goods, tractors and other agricultural machinery, fertilisers, and so on must be ensured.

According to USSR Central Statistical Board data, between 1965 and 1975, about 28 per cent of the capital goods produced in Department I were designed for Department II, this figure being stable over the years. In this way, the priority growth of Department I far from conflicts with the task of raising the production of consumer goods and the population's standard of living. Rather, it facilitates the achievement of these targets with a lower expenditure of social labour, higher efficiency and in a shorter time.

Lenin wrote: "...In *the final analysis* the manufacture of means of production is necessarily bound up with that of articles of consumption, since the former are not manufactured for their own sake, but only because more and more means of production are demanded by the branches of industry manufacturing articles of consumption."[1]

Apart from the growth of per capita consumption already mentioned, the opposite trends must also be taken into account. As a result of technological progress, the increase in labour productivity, and the fall in the amount of

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[1] V. I. Lenin, "Reply to Mr. P. Nezhdanov", *Collected Works*, Vol. 4, p. 163.

material and assets consumed per unit of output, the demand for the output of Department I and the cost of this output going into the production of both capital goods and consumer goods, are falling and this checks the growth of the share of Department I.

In order to judge the relative growth of both departments in the future, we must not confine ourselves to theoretical considerations, but make concrete calculations. The planning and statistical agencies have such data at their disposal. These consist of the intersectoral balance-sheet for production and distribution of output in physical and value terms. Feeding this into computers, all the direct and indirect expenditures of raw and other materials, energy, manpower and also capital investment needed for the production of each type of output can be exactly determined for the past and the future.

The relation between departments I and II objectively necessary for high rates of reproduction is reflected in the national economic plans. When the plans are compiled, account is taken of the fact that production in Department I furthers scientific and technological progress, providing the economy with advanced technology, satisfies a number of demands, both social and personal, and strengthens the country's armed forces. It is these targets that to a considerable degree determine the branch structure of industry too.

3. THE TASKS INVOLVED IN DEVELOPING THE MAIN BRANCHES OF INDUSTRY

Data on the share of individual industries in the gross product and in the numbers of production personnel provide a picture of the branch structure of industry (see Table 31).

In 1975, three industries (engineering and metal-processing, the light and food industries) accounted for 61.7 per cent of the gross product and 64.4 of the labour force. From 1960 to 1975, the share of engineering and metal-processing, the chemical and petro-chemical industries and the power industry in the gross product and in the labour force increased. That of the building-materials industry

Table 31

The Branch Structure of Industry in the USSR (per cent of total)[1]

	Gross Product				Industrial Labour Force			
	1960	1965	1970	1975	1960	1965	1970	1975
All industry	100	100	100	100	100	100	100	100
Power industry	2.9	2.9	2.9	2.8	1.7	1.9	2.0	2.0
Fuel	7.7	6.2	6.1	5.7	7.0	5.7	5.1	4.2
Chemical and petro-chemical	3.9	6.0	6.1	6.9	3.5	4.6	5.1	5.1
Engineering and metal-processing	16.6	23.0	23.8	27.8	31.8	36.2	39.4	40.5
Timber, wood-processing and pulp-and-paper	6.9	5.2	5.1	4.6	11.9	10.3	9.2	8.2
Building materials	4.1	4.1	4.1	4.1	7.0	6.3	6.5	6.3
Light	22.5	17.0	16.8	14.9	17.1	15.7	15.9	15.0
Food	25.9	21.2	20.7	19.0	9.8	9.4	9.5	8.9

[1] See *The National Economy of the USSR in 1975*, pp. 197 and 211.

in the gross product also rose. These changes in the structure of industry are progressive in nature, as they reflect the particularly rapid development of industries that lead technological progress. The chemical and petro-chemical, fuel, and food and power industries give more gross product per worker than do engineering and metal-processing, the timber, wood-processing and pulp-and-paper industries and the building-materials industry.

The share of the power industry in the gross industrial product is not great, only 2.0 per cent but its significance is enormous, as the technical level of production depends on electric power. From 1965 to 1975, the amount of electricity produced rose by 105 per cent, i.e., more than the national income (82 per cent), but less than the output of industry as a whole (115 per cent). The growth in the output of electricity permitted a significant increase in its consumption in the different branches of the national economy, as can be seen from Table 32 (see also p. 194).

The share of transport facilities in the overall consumption of electricity in the country has risen and, in the last twelve years, that of agriculture has shown a marked increase as well. The share of industry has fallen somewhat, but the level is still high. In the future, there will be a substantial rise in the consumption of electricity in agriculture, and also in household consumption and in the services, while that in transport facilities will drop somewhat.

The overall capacity of electric power stations in 1975 was 217.5 million kw, of which thermal power stations provided 177 million and hydro-electric power stations 40.5 million kw.

The production of electricity will increase mainly from thermal electric power stations, which at the present time provide 88 per cent of all the electricity produced, but in the future this figure will be even higher. The share of hydro-electric power stations is unlikely to increase substantially, even though several major hydro-electric power stations are to be built or are already under construction.

The fuel industry, which provides 6 per cent of the total gross product, has undergone considerable structural changes in recent years owing to the rapid development of oil

Table 32

The Electricity Balance of the National Economy[1]

Year	Output, thousand million kwh	Consumption by branches, thousand million kwh											
		Industry		Transport		Agriculture		Others		Losses		Export	
		absolute	per cent	abso-lute	per cent	abso-lute	per cent	absolute	per cent	abso-lute	per cent	abso-lute	per cent
1950	91.2	65.2	71.6	3.7	4.0	—	—	16.0*	17.5*	6.3	6.9	—	—
1960	292.3	207.5	70.9	17.7	6.0	—	1.3	45.4	15.5	17.8	6.3	0.03	—
1970	740.9	488.4	66.0	54.4	7.3	38.6	5.2	96.0	12.9	58.3	7.9	5.2	0.7
1975	1,038.6	656.8	63.2	74.2	7.1	73.8	7.1	140.3	13.5	82.2	7.9	11.3	1.1

[1] See *The National Economy of the USSR in 1975*, p. 228.
* Including agriculture.

and gas extraction. The share of oil has increased from 21.1 per cent in 1955 to 35.8 per cent in 1965 and 44.1 per cent in 1975, while the respective figures for gas are 2.4, 15.5 and 21.8 per cent. At the same time, the share of coal dropped from 64.8 per cent in 1955 to 42.7 per cent in 1965 and 30.8 per cent in 1975. This change has had a stimulating effect on the national economy, for oil costs only a quarter as much as coal, and gas only a ninth as much.

Apart from the use of oil and gas as fuel, the proportion of these substances being used as chemical raw materials is growing. The oil-processing industry will produce substantially more high-quality products—low-sulphur diesel fuels, high-octane petrol, lubricants with various efficient additives.

In the coal industry, strip-mining is becoming increasingly important. In shaft mines, the technical level and the productivity of labour are rising as a result of all-round mechanisation and automation. This makes it possible to extract more coal with a substantially smaller labour force (up to 20 per cent less).

Iron-ore mining is a major branch of the extractive industry as it is the basis of the iron-and-steel industry. In recent years, the share of the Kursk Magnetic Anomaly in the extraction of ore with a high iron content has begun to increase, as has the transportation of these ores to the Urals.

Recent decades have seen a gradual drop in the share of the extractive industry, as a result of more rational utilisation of raw materials and a decrease in the amount of material used per unit of output, and as such this should be seen as a positive trend.

Industries producing construction materials—the ferrous and non-ferrous metal industries, chemical and petrochemical industries, and the production of building materials—are going over to producing modern materials and improving their quality.

The increase in the output of aluminium is of major importance as this metal is essential for the development of the aircraft industry and is also coming into wider and wider use. There are not sufficient bauxites in the USSR, but not enough is done to obtain aluminium using the nepheline deposits on the Kola Peninsula.

Engineering is a branch that is of particularly great importance for the development of the national economy both at the present time and in the future. The share of this industry (with metal-processing) in all Soviet industry in terms of the number of workers was 40.6 per cent in 1975, against 31.8 per cent in 1960. In terms of the gross product, the share of engineering is smaller (27.8 per cent in 1975), although it increased during the 1960s from 16.6 per cent in 1960.

The share of engineering will continue to increase, primarily owing to the rapid development of those subsidiary industries that are of particular importance for technological progress.

Instrument-making will also develop further: the output of instruments and apparatus for automatic installations, digitally controlled machine-tools and automatic transfer lines, computers, radio and television apparatus and electronic devices. The production of automatic instruments and equipment grew by 63 per cent from 1971 to 1975, while that of computers increased by 223 per cent. This growth will continue into the future with a view to fulfilling the ambitious programme for automating production and management. This requires tens of thousands of computers, automatic machine-tools and transfer lines, communication facilities and other equipment. No small role will be played in this by international socialist integration and the participation of the CMEA member-countries in setting up interconnected computer systems.

Furthermore, the development of chemical engineering is a major target. From 1971 to 1975, this industry expanded by 49 per cent. In power engineering more and more up-to-date generators of high capacity are being developed for thermal and hydro-electric power stations. The annual output of turbines and generators has been 15-19 million kw for the last few years, and that of alternating current motors was 42 million kw in 1975.

The production of agricultural machinery has been increasing recently, at 10-12 per cent a year. The total horsepower of tractors produced has been growing at an annual rate of 6-7 per cent. In 1975, 550,000 tractors were produced, with an overall capacity of 42 million h.p., includ-

ing quite a few with up to 275 h.p. In 1973, 97,500 combine harvesters were produced. Agricultural engineering must raise its output substantially and produce many new varieties of machines if it is to fully satisfy the demands of agriculture.

Transport engineering, and above all, motor vehicle construction, is developing considerably. The new car plant in Togliatti is working at full capacity and has already set an example with the rapid rate at which it was put into operation, its advanced organisation of production and high-quality output. The output of cars is also going up at the car plants in Moscow and Izhevsk. Construction of the enormous heavy-duty motor vehicle plant on the Kama is in full swing. In 1975 1,201,000 cars and 696,000 lorries were produced in the USSR, plus 67,000 buses. The powerful motor vehicle industry in the USSR exerts considerable influence on technological progress in the country, securing the increase in freight and passenger traffic. There is also a need to develop the production of trailers, some of which are produced in small batches or even singly and are, therefore, expensive, while the demand for them is great.

Transport engineering fulfils the important task of supplying the railways with the diesel and electric locomotives that, with a few exceptions, now handle the bulk of hauling operations. At the present time, about 1,500 diesel and 350 electric locomotives of increasing power are produced annually. In 1975, 70,000 freight and 2,090 passenger cars were also built.

Connected with the development of agricultural and transport engineering is the growth of the production of roller bearings.

Development of the output of handling machinery and other equipment for mechanisation of heavy and labour-intensive work in industry is particularly important, above all in the extractive industry and many manufacturing branches (cranes, conveyors, electric fork-lifts, automatic loaders, stackers, overhead handling equipment, and so on), and also in construction, transportation and agriculture. Mechanisation of these industries will release many workers employed in manual labour. It is essential that the production of containers, an important means for

rationalising freight carriage, should be substantially increased.

There will also be an increase in the output of construction and road-building machines, excavators, bulldozers, scrapers, graders, road rollers, road-cleaning machines and many others in connection with the expanding construction of roads, buildings and municipal service installations.

There are important tasks to fulfil in the production of equipment for the light and food industries, and also for trade, public catering and domestic service enterprises.

We have left out many other tasks facing engineering—the production of equipment for the metallurgical, mining, oil, gas, timber and other industries.

All branches of engineering must not only create new machinery and equipment, up-to-date, more powerful and productive, but also increase production for replacing existing equipment as mentioned above. This is one of the major tasks before engineering and a substantial proportion of its output is intended for these purposes. This is a task that cannot be fulfilled immediately and as such will continue to face the industry in coming years.

In order for engineering to be able to fulfil its major function of re-equipping the economy, it must continue to develop rapidly. Since the Revolution, engineering has received about a sixth of the capital investment in industry and during the Eighth and Ninth Five-Year plan periods (1966-75) it received about a fifth, i.e., substantially more than other industries, such as the power industry, the fuel industry, ferrous metallurgy, or the chemical industry. Even so, it continues to lag considerably behind these other industries in terms of the growth rate and level of the assets-output ratio.[1] This in no small way explains the fact that the number of workers in engineering has increased much faster than in other industries, while the organic composition of assets in this branch is lower than in the power, fuel, metallurgical and chemical industries. Engineering is also behind other industries in the amount of energy consumed per unit of output. All this makes it essential for

[1] See K. I. Klimenko and Y. V. Petrova, *The Economic Efficiency of Technological Progress in Heavy Industry in the USSR*, Moscow, 1971, pp. 148-49 (in Russian).

the development of productive assets in engineering to be speeded up and for the branch to be equipped with the most up-to-date machinery. These were the tasks of the Ninth Five-Year-Plan period, and they have not lost their importance today.

During the last five years, 25 to 30 per cent of metal-cutting machine-tools and 30 per cent of forge presses went to replace obsolete equipment in engineering enterprises. There has been an increase in the output of machine-tools of high and very high accuracy for grinding and friction finishing of automatic and semi-automatic machinery, forge press, casting and welding equipment and also in the output of specialised metal-cutting, abrasive and diamond instruments of significantly higher quality.

Engineering is being automated on a wide scale. In 1965, there were 2,965 automatic transfer lines in operation in the engineering and metal-processing industries, while in 1975 there were 8,116. The number of automatic and semi-automatic machines, specialised and integrated units increased considerably in the motor vehicle and tractor industries and agricultural engineering.[1] Industry in the USSR already produces more automatic and semi-automatic transfer lines than that in the USA. Stamping and forge presses are being used on an increasingly wide scale and the share of metal-cutting is falling. This helps to reduce waste and losses of metal. Modern casting methods in moulds and chills, and centrifugal casting are becoming more and more wide-spread. Advanced methods such as electro-erosion, electro-chemistry, ultrasound, abrasive machining and so on are being widely introduced.

The Soviet Union's industry is faced with the task of substantially improving the quality of output, which will help lengthen the service life of equipment and make Soviet goods competitive on the international market.

In the light of the major economic task of raising the population's standard of living, the production of consumer goods is also expanding. In 1975, the consumer goods industry—Group B industries—produced 37 per cent more

[1] G. Vasilyev, "The Development of Automation in Engineering", *Voprosy ekonomiki* (Problems of Economics), No. 7, 1974, p. 67 (in Russian).

than in 1970. This includes the light and food industries, and also the output of some branches of heavy industry that produce consumer goods. In 1975, the output of light industry was 25 per cent above its 1970 level, including an increase of 12 per cent in the production of fabrics and of 33 per cent in that of knitwear. In terms of quantity, as already mentioned, the demand for light industry products is close to being satisfied, but with the increasing incomes of the population, the main target is to satisfy the demand for goods of higher quality.

The gross product of the food industry increased by 29 per cent between 1970 and 1975, while the individual rises were 38 per cent for meat (9.8 million tons), 29 per cent for sausages and hams (3.0 million tons), 28 per cent (1.2 million tons) for butter and fats, 20 per cent (23.6 million tons) for whole-milk products, 36 per cent (14.6 million standard tins) for the canning industry and 12 per cent (3.2 million tons) for confectionery. The problem remains to increase the output of meat and meat products, and also to raise the proportion of high-quality output.

The output of consumer durables produced by heavy industry rose from 1971 to 1975 by 25 per cent. There was a substantial rise in the production of refrigerators (35 per cent), motorcycles and scooters (24 per cent). The output of TV sets, washing and sewing machines has dropped since 1970, partly because the customers are not satisfied with the machines available on the market. Industry must react quickly to changes in demand, take account of these changes and improve the product range and quality of its products. In turn, the trading network must not accept goods from industry if their quality is not adequate and they are not in keeping with the contract. A new rise in the output of TV sets began in 1973 after the appearance of colour TV sets and improvement of other TV types.

Industry must be equipped with modern machinery if it is to increase the output of consumer goods. The production of equipment for light industry rose by 61 per cent from 1970 to 1975, while the increase for food-industry equipment was 42 per cent. High-capacity automatic looms, automatic flow-lines for the dyeing and bleaching of cotton fabrics, for the production of woollen fabrics, spinning-and-dyeing

machines and other equipment raising the productivity of labour are being installed in the textile industry. Shoe factories are being equipped with modern machinery, including equipment for producing footwear by pressure moulding. The food industry is being supplied with automatic production lines and other equipment for the mass production of meat, sausages, fats, milk, sweets and other products.

The use of new methods to raise the quality of output is of major importance in the food industry. The introduction of continuous production processes, new methods for drying and instant freezing, which maintain the food-value of the product, the use of ultra-sound to increase the yield from vegetable raw materials and ultra-violet light for sterilisation, will continue in the future. Storage is improving with the use of ventilation and new preserving methods are coming into use. Bottling and packing are becoming mechanised and automated. All this makes satisfaction of the needs of the industries of Department II a major task for engineering and the other branches in Department I.

4. CONCENTRATION OF PRODUCTION

The growth of industry is based not only on the technical equipment available and the efficiency of new technology, but also on improvement in the social organisation and management of industry—the concentration of production, specialisation and co-operation, collaboration and distribution. All these forms of the organisation of production are closely interlinked. For example, the specialisation and distribution of production have a bearing on the optimal level of production concentration, while rational distribution, in turn, is determined by concentration and specialisation.

This is why a comprehensive approach is needed in determining optimal organisational forms. A balance must be established that will ensure the maximum economic efficiency of production.

The growing concentration of production is one of the characteristic features of the development of Soviet indus-

try. This can be judged (a) from the growth of production and (b) from the shares of very large enterprises (in terms of volume of output, number of workers and size of assets).

In 1964, 9 per cent of industrial enterprises had a gross product of over 10 million rubles, while in 1968, 11.7 per cent were in this category, and in 1973—16.2 per cent. In 1964, these large enterprises produced 63.4 per cent of all output, 70.8 per cent in 1968, and 77.3 per cent in 1973. Enterprises with a gross product of over 50 million rubles constituted 1.4 per cent in 1964 and produced 29.7 per cent of all output, while by 1968, the number of such enterprises had risen to 2 per cent and the output they produced had increased to 37.7 per cent. The respective figures for 1973 were 3.2 per cent and 45.6 per cent.

In 1960, 7.1 per cent of enterprises employed over 1,000 workers and produced 52.8 per cent of all output. In 1968, 9.9 per cent of enterprises were already in this group and they produced 57.7 per cent of all output, while by 1973, their share had risen to 11.2 per cent and their output to 61.5 per cent. In 1968, 2.4 per cent of enterprises had more than 3,000 workers and produced 33.6 per cent of the output, while in 1973 there were 2.8 per cent of such enterprises, producing 35.6 per cent of the output.

In 1964, 4.7 per cent of enterprises had fixed assets of over 10 million rubles, and these produced 38.5 per cent of the gross product. The figures for 1968 were 4.9 per cent and 42.3 per cent, respectively, and for 1973, 7.5 per cent and 51.1 per cent.

All these figures testify to the continuing concentration of production in Soviet industry, which is now the most concentrated industry in the world. In the USA, for example, 90 per cent of enterprises have an average annual staff of up to 100, while only 0.2 per cent of enterprises have more than 3,000 workers each. These produce 22 per cent of all output, i.e., the share of these enterprises is some 60 per cent of that in the USSR.[1]

Concentration of production in the USSR is facilitated by socialist ownership of the means of production, which makes it possible to allocate resources for building enter-

[1] See R. S. Lifshits, *The Efficiency of the Concentration of Production in the Industry of the USSR*, Moscow, 1971, p. 55 (in Russian).

prises of the most economical size according to a plan. Under capitalism, however, large enterprises are beyond the reach of many entrepreneurs and it is far from easy to make use of the mechanism of capital centralisation.

Large-scale production has a number of advantages, including the possibility of using powerful and advanced machinery that can be operated at full capacity making better use of raw and other materials and manpower, raising the productivity of labour and reducing production costs.

Of great significance is the possibility of setting up laboratories and design offices in large enterprises, along with auxiliary workshops, side-lines and waste-processing plant. As a result of all this, labour costs are reduced: capital investment is lower and the return on assets higher.

Concentration of production is particularly efficient in those industries in which it is based on increasing plant capacity—turbines, blast furnaces, rolling mills, oil-processing plant, cement kilns, and so on. This is why the capacity of new electric power stations, metallurgical, oil-processing, cement and other plants is rising rapidly. At the present stage of technology there are, of course, optimal sizes of enterprises in these industries. These are determined not only by the technical possibility of raising plant capacity, but also by the area occupied, the complexity of production organisation, the increase in the cost of raw materials and delivering the finished product to the consumer, as the distances that these have to be transported are longer than for smaller enterprises.

These limitations manifest themselves to an even greater extent in industries in which the size of an enterprise depends on the number of units of equipment, for instance, in the engineering or the textile industry. Even here, the capacity of each unit can be increased by introducing automatic machine-tools, for example, but the number of machine-tools should not be raised above the optimal level.

In order to determine the optimal size for an enterprise in each industry, calculations should be made on specific capital investment, production costs and comparable costs. With an increase in the size of the enterprise, these indicators decrease—first very rapidly, then more slowly and once

the optimum level has been attained, they begin to grow. The results of such calculations were given for the power and other industries in Chapter VII.[1] On the basis of these calculations, the optimal size of an enterprise can only be established approximately. For a given enterprise, individual calculations are needed reflecting the special features of the enterprise, the location of sources of raw materials, fuel and energy, of sales markets and the like.

Considerations that are difficult to include in economic calculations should also be kept in mind. The modernisation and installation of new, more complex and expensive machinery in a large enterprise takes longer than in a smaller one. Furthermore, the nature of the enterprise and its specialisation are also of major importance.

Large general-type enterprises, manufacturing many varieties of products, may prove inefficient in comparison with smaller specialised enterprises, producing a more specific item than the general-type enterprise, at a higher technical standard. This testifies to the significance of the connection between concentration and specialisation of production.

In some industries, accuracy and quality depend on the skills of the workers. This is particularly true in the production of high-quality output, such as complex assemblies in instrument-making and the radio industry, and also in the watch-making and clothing and other industries serving the population. Here, too, smaller enterprises might be more efficient.

Finally, over-concentration of production in only a few large-scale enterprises is also undesirable in defence terms.

It can thus be concluded that the considerable advantages of large-scale production do not mean that the largest possible size of enterprise is always the most suitable. Excessively large plants are not desirable, and are even harmful. Lenin wrote that "the law of the superiority of large-scale production is not as absolute and as simple as is sometimes thought...."[2] For each industry and each area, at the given level of technology, there is an optimal scale of

[1] See also *The Question of the Optimal Scale of Enterprise in the Industry of the USSR*, Moscow, 1968 (in Russian).

[2] V. I. Lenin, *Collected Works*, Vol. 4, p. 119.

enterprise and, in certain circumstances, along with large scale enterprises, small ones may prove efficient.

In the future, concentration will continue in many branches of industry. These include, as we have seen, the power industry, the iron-and-steel industry, the oil-producing industry, the chemical and other industries.

At the same time, no significant increase in productive capacity is likely to prove feasible in large engineering plants, textile factories or other enterprises, where an increase in the volume of production necessitates installation of additional plant, expansion of workshops or of the factory site. The growth of such enterprises is limited by management difficulties, complication in the organisation of production, and so on. In the future, production in these industries will expand both through a possible increase in the productivity of equipment, due to automation, for example, and through the construction of new enterprises.

Apart from becoming more concentrated, production is also becoming more centralised, its management is being reorganised on the basis of associations, and two- and three-stage systems of industrial management are being set up.

It is now production associations and amalgamations, as the largest enterprises of a modern type, that are becoming the major stage in social production. These include, for example, the Magnitogorsk amalgamation of metallurgical plants, the motor-industry association in Moscow and other motor-industry associations, associations in the textile, clothing, footwear and confectionery industries. Associations are set up to amalgamate large specialised enterprises in which the use of the most up-to-date technology is feasible, as are efficient organisation of production, automatic control systems and scientific and design departments. All these ensure a high standard of production, experimental production, supply and auxiliary services, and so on. Production associations and amalgamations are legal entities operating on a self-financing basis and dealing directly with the state, in a centralised manner, on behalf of all their sub-units.

The advantage of such an association or amalgamation over individual enterprises consists in a combination of high concentration and specialisation, in a high degree of mobility in the utilisation of means of production and manpow-

er, in the incentive funds and, when necessary, in their redistribution and also in more precise organisation of supplies and sales. On the other hand, the association is much closer to actual production than is the chief administration ("glavk") of the ministry and, as it operates on a self-financed basis, it has a direct interest in the smooth running of its units. Under these conditions, the association is largely responsible for requests it makes for capital construction being justifiable, and it can be granted funds for this purpose on credit.

With the two-stage management system, associations are directly answerable to the ministry, which is the most rational system though it is not always feasible. If there are a large number of narrowly specialised enterprises, an intermediary stage has to be set up—self-financed industrial associations (all-Union or republican) which may be made up of independent self-financed enterprises and production associations, and also scientific research and design organisations, experimental factories and testing grounds, etc. Industrial associations of this type include, for example, the All-Union Association for the Bearing Industry, which is composed of twenty specialised bearing plants, along with various scientific, technical and other organisations. The distinguishing feature of the industrial association is that, along with its member enterprises, it is not an administrative management unit, but a production complex. This is a major advantage of the production association over the ministry's chief committee. Management through the agency of the production association is more flexible and responsible, even though in this case the management system has three stages.

At the beginning of 1976, there were 2,300 production and scientific-production associations, comprising 8,700 enterprises and production units that previously had their own independent balance-sheets. These produced 24 per cent of the industrial output. It is the light and food industries that have the largest number of associations, with 40 per cent of the total. The biggest associations are found in engineering, however. The share of associations in the sales of the industrial product averages about a quarter, while it is highest in the motor industry, more than 50

per cent. In light industry it stands at a third, as it does in tractor and agricultural engineering, while in electrical engineering it is more than 25 per cent.

The establishment of associations to which a significant proportion of the day-to-day management functions of the ministry are transferred, makes it possible to concentrate resources on solving major problems connected with technological progress and the future development of production, capital investment, improvement in control systems and their automation and study of the demand for the industry's output. The possibility is not excluded that, in the future, ministries themselves might be transferred on to a totally or partially non-subsidised basis, in order to raise the interest of the ministry apparatus in the efficient operation of the enterprise systems under its jurisdiction.

5. SPECIALISATION AND CO-OPERATION IN PRODUCTION

Two major ways of raising the efficiency of Soviet industry are specialisation and co-operation of enterprises as developed social forms of the distribution of labour and organisation of industrial production. Specialisation consists in the isolation of individual types of production, the formation of new industries and enterprises with a limited product range and increased design and technological homogeneity of production. The concentration of the manufacture of individual products in an enterprise and production homogeneity make it possible to increase the volume of output. Mass production makes automation and the use of the most advanced equipment profitable. Specialisation helps to raise labour productivity and to reduce production costs, capital investment per unit of output and current costs. Specialisation must begin at the level of the individual machine, the sector, the shopfloor, and spread to the enterprise and to the entire industry.

Specialisation is thus a progressive form of production development. It is in keeping with the high technical level and planned nature of socialist industry, and requires

exact organisation of planning and management. During the last few years, there has been an advance in specialisation of production in the USSR, and this will continue into the future. At the same time, specialisation is impossible without close co-operation in production.

Industrial production is growing by the year; new types of product are appearing; the product range and variety of design are expanding. All this necessitates a rational distribution of output between branches and sub-branches, and between enterprises within the branch. The need arises to single out new branches and sub-branches of production. In engineering, the electronics industry and instrument-making have been created; within the chemical industry there is the production of synthetic fibres and of plastics; in the building-materials industry there is the production of prefabricated ferro-concrete units and parts and wall panels. The new branches of the wood-processing industry are wood-fibre and chip-board production, and new specialised branches have sprung up in the light, food and other industries. According to the USSR Central Statistical Board data, the number of industries already exceeds 300 and is continuing to rise. Many sub-branches that exist in reality are not yet reflected in industrial classifications. The growth of branch specialisation is one of the indicators of the level of development of socialist industry and of technological progress in the country. Evidence of this growth can be found in the increase in the share of output of a branch type, which reflects the degree of homogeneity of production, i.e., how much the industry produces of the main article of manufacture (meaning that the remainder is output not conforming to the industry's specialisation).

By 1970, in engineering the share of output of a branch type in the overall volume of this industry's output was as follows: 92 per cent in the motor industry, 93 per cent in instrument-making, 99 per cent in electrical engineering, and the lowest—68 per cent—in heavy, power and transport engineering. The share of specialised output in national production of a branch type output ranged from 65 per cent in instrument-making, and in the manufacture of hoisting and transport facilities, to 88 per cent in chemical engineering and 90 per cent in machine-tool building (met-

al-cutting machine-tools).[1] Even so, the production of a substantial proportion of basic output is still dispersed among different industries.

Industry's success in the development of article specialisation, meaning the output of a particular type of finished product, raises the efficiency of production. In engineering, specialised plants produce various types of equipment for metallurgy, the power, mining, oil, chemical, light and food industries, construction, transportation and so on. A more advanced form of article specialisation is the production by a given plant of equipment of a specific type, such as electric motors, boilers or machine-tools. Article-specialised enterprises can include all the production processes necessary for producing the given article—supply, manufacture and assembly—or only the assembly stage, after receiving the various parts and units from other enterprises. The first form of specialisation is less progressive, while the second requires close co-operation between enterprises, and it is this second form that promises to develop in the future.

Component specialisation, meaning the production by a given enterprise of identical units or parts of the finished product, is as yet less developed in industry. Component specialisation is a progressive and efficient form of specialisation, that permits mass production, the use of automatic machine-tools and production lines and their full-capacity operation. It also obviates the need for re-adjusting automatic machines to produce other types of output, reducing delays, cutting the requirements for raw materials, metal and power, and releasing some of the workers. Component specialisation has good prospects and in the future, during the creation of the material and technical base of communism, it will become the main form of specialisation. An increasing proportion of finished products will be assembled from components delivered to the specialised enterprise. The share of component specialisation does not yet exceed 10 per cent in engineering output.

[1] See M. V. Gazaliyev and T. P. Nikonova, *Planning and Economic Stimulation of Specialisation of Industrial Production*, Moscow, 1974, pp. 25, 35 (in Russian).

In 1970, the share of output from specialised enterprises and centralised workshops engaged in the manufacture of parts and units in the overall commodity output of the majority of branches of engineering was from 1.2 to 5.2 per cent, 8 per cent in heavy, power and transport engineering, 9.5 per cent in instrument-making and only reached 24.4 per cent in tractor building and 38.2 per cent in the motor industry. Another progressive form is technological specialisation, when a particular enterprise concentrates on individual stages in the production process, such as the preparatory stage or auxiliary processes. This form of specialisation envisages the manufacture of castings, forgings, rigging and instruments, the repair of equipment, and so on. It is extremely efficient to produce these articles of all-industrial designation on a centralised, mass basis and thus release other enterprises from this production. The following comparison illustrates this point. In engineering, 40 per cent of instruments and rigging are produced at specialised enterprises employing 70,000 workers. The remaining 60 per cent are produced by 420 workshops within different enterprises, and these shops employ 460,000 people. This means that non-specialised enterprises require 350 per cent more workers per unit of output than specialised ones do.[1] The share of this form of specialisation is as yet lower than that of component specialisation. Of the nine branches of engineering, only in the motor industry is the share of output from specialised enterprises and centralised workshops engaged in individual stages of the production process as high as 5.3 per cent of the total volume of commodity output, while in the other branches it is much lower.

Selective research carried out by the USSR Academy of Sciences Institute of Economics illustrates the share of the three forms of specialisation in engineering. According to these data, of the 2,000 engineering plants, 80.5 per cent were specialised by the type of finished machine (article specialisation), 17.3 per cent by parts and units and 1.8 per cent by stage of the production process.[2] Article-special-

[1] See *Questions of Economics*, 1973, No. 12, p. 31.

[2] See Y. M. Karlik, A. P. Gradov, *The Economic Efficiency of Design and Specialisation of Production in Engineering*, Moscow, 1970, p. 28 (in Russian).

lised engineering enterprises produced 86 per cent of the gross product of engineering. These figures show that the share of component and particularly of production-stage specialisation is not high enough and should be increased.

Specialisation is highly efficient, but is extremely difficult to implement. The product range of each enterprise can be studied and reduced, transferring some articles to other enterprises. This is actually being done. The number of enterprises used by other ministries to produce articles of a type required by these ministries is falling. In the enterprises of some ministries (such as in the machine-tool and instrument industry) decentralised production of articles for use in many industries is on the increase. The question arises whether a whole "branch for inter-branch production" be set up in engineering.

What is the reason for the insufficiently broad implementation of specialisation and what measures can be taken to speed up this process?

First of all, it should be noted that industry in the USSR has developed mainly on the basis of enterprises with an integrated structure and a closed production cycle. These enterprises produce castings, rigging and instruments as well as their main output. This type of enterprise made it possible to organise output, particularly of new items, in the shortest possible time, as it was not expected that the necessary parts and units would begin to be produced in other places whence they could be obtained.

At the present time, it is fully possible both for new enterprises to be planned and built on a specialised basis with the most up-to-date equipment, and for existing enterprises to become more narrowly specialised. The development of specialisation must be envisaged in the plans for scientific and technological progress and those for specialisation, and when specialisation projects are approved, stricter control must be exerted by the ministry, the State Construction Committee and the State Planning Committee. The as yet insufficient development of plants and workshops for the specialised, centralised production of parts and units, semi-finished goods and articles cannot, of course, be ignored.

All this shows that specialisation, as an advanced form

of social organisation of production, is closely interconnected with the other no less advanced form—co-operation. The general type of enterprise can be abandoned only if everything needed for the production and assembly of the finished product is available in the necessary quantity and is supplied by other enterprises on time.

This requires extreme precision in the work of enterprises linked together by successive production processes. Instances still occur, however, when it is planned for an enterprise to receive output from others that are not yet even being built or have not yet developed their full capacity in producing this type of product, or even that have gone over to a different type of output, and such plans cannot be fulfilled on time. In order to avoid breakdowns in production resulting from the non-fulfilment of mutual supply obligations, enterprises add various workshops produce "their own" castings, tools, and sometimes even parts and units. This, of course, is a backward, antiquated way of ensuring supplies of everything necessary for uninterrupted production and it does not correspond to the principles of contemporary organisation. The new system introduced in July 1974 making one of the indicators of plan fulfilment the fulfilment of output supply contracts will help to improve co-operation in industry. The 25th Congress of the CPSU stressed the special significance of precise fulfilment of supply targets under co-operation plans, as this largely determines the rhythmical nature of the work of all industry and the efficiency with which productive capacities are utilised. On the other hand, even when there is specialisation of production, the question might arise of the possibility of producing additional types of output. Such diversification is expedient when it permits the utilisation of reserves of productive capacity in the enterprise—either equipment or buildings, and also constantly forming material waste, and with relatively small additional outlays, the receipt of substantial benefits. The Likhachev motor plant, for example, produces the best refrigerators in the USSR. Other engineering and metal-processing plants produce such consumer goods as metal pots and locks. The product range of many chemical plants is fairly broad and includes consumer goods. It is

often the production process itself and the presence of by-products or waste that can be utilised that makes it expedient to produce a variety of products. For example, the benzene from the coking batteries of metallurgical plants is the raw material for the production of a whole series of chemical products and the sulphur gases from copper-smelting works can be used to produce sulphuric acid in large quantities. In all these instances, the production of the by-product is essential and its absence is a sign of irrational organisation of production. The construction of side enterprises to ensure comprehensive utilisation of raw materials is economically expedient and raises the efficiency of production. Enterprises are not always readily willing to start producing additional kinds of output, particularly if this calls for substantial additional investment and sometimes even changes the nature of production. This is why detailed economic calculations are needed to prove the efficiency of such measures, as are economic incentives to interest the enterprise in the processing of byproducts.

Furthermore, speaking of measures that are necessary to develop specialisation, the following must be kept in mind. Technological progress means a rapid increase in the quantity of different types of product, in the product range and size. In engineering alone, there are over 130,000 types of machine and equipment with different types of units and parts. The motor plant in Gorky, for example, requires 55,000 different parts and the Likhachev motor plant in Moscow requires 50,000.

Standardisation of articles and their parts must be increased. There is hardly any need, for example, to produce many types of equipment intended for the same purpose (metal-cutting equipment, pumps, refrigerators, and so on), as each type has its own separate parts and units—some 50, 75 or even more per cent. The State Standards Committee has done research showing that the level of standardisation should be increased by 100 to 200 per cent in the leading branches of engineering if the level of world technology is to be reached.[1]

[1] See M. V. Gazaliyev and T. P. Nikonova, *Planning and Economic Stimulation of Specialisation of Industrial Production*, Moscow, 1974, p. 71 (in Russian).

Reducing the number of types of products, units and parts would help to increase production specialisation.

An improvement in planning is also of considerable importance for the further development of specialisation. Nowadays, specialisation plans are included in the national economic plans. They are compiled according to methodological instructions issued periodically by the State Planning Committee on the elaboration of state plans for the development of the national economy of the USSR. These include the determination of the production specialisation of enterprises and redistribution of the finished product, the development of production specialisation and calculations of the efficiency of specialisation. Specialisation plans on the national level are supplemented and itemised by plans on the level of the industry and the enterprise.

Along with an improvement in the planning of specialisation and control over the fulfilment of plans, economic incentives to specialise must be introduced. Primarily, obstacles must be removed, such as the price of parts obtained from elsewhere being too high, well below the cost of producing them in the given enterprise.

New prospects are opening up as a result of the establishment of associations with large material and labour resources for distributing output more correctly among their member enterprises, and also for co-operation with other enterprises, and thus for further developing specialisation.

With the development of the economies in the countries of the socialist community, the importance of international socialist co-operation is growing, meaning specialisation by country. Poland and Czechoslovakia, for example, co-operate in the production of buses. Poland and the German Democratic Republic in that of integrated machine-tools, Poland and Hungary in parts for buses and lorries, the USSR and Hungary in the production of buses, the USSR and Bulgaria in that of passenger cars. Yugoslavia co-operates with the German Democratic Republic in the production of electrical engineering equipment and with Hungary in that of cranes, agricultural machinery, and so on. There are a multitude of such examples, but even so, there are far greater opportunities for further development of co-operation and collaboration among the socialist coun-

tries in the light of the Comprehensive Programme for the Extension and Improvement of Co-operation and the Development of Socialist Economic Integration by the CMEA Member Countries.

6. RELOCATION OF INDUSTRY TO THE EASTERN PART OF THE SOVIET UNION

For a number of years there have been changes taking place in the location of industry in connection with the accelerated development of industry in the East and South of the USSR—in the Urals, Siberia, the Far East, Central Asia and Transcaucasia. The East and South of the country have large natural resources, the exploitation of which is a major condition for the development of production. These areas have most of the unmined deposits of coal, oil, non-ferrous metals, timber, hydro-power and vast expanses of fertile land, but less than 30 per cent of the population, and not counting the Urals and Central Asia, only 10 per cent. The eastern areas are the location for a particularly rapid development of industries producing the basic products—energy and raw materials. These include the power, fuel, metallurgical and timber industries. Industries requiring a large number of workers, particularly with high skills (for example, engineering, and the chemical and light industries) are less developed.

The large natural resources mean that capital investment may yield big returns, particularly in raw material and fuel extraction and preliminary processing. The development of a number of raw-material industries in the East is highly efficient. The utilisation of the iron ore of Mount Magnitnaya in the Urals and the establishment there of a large iron-and-steel plant has ensured a low production cost of pig iron.

On the other hand, the development of industry in the East, and particularly in the northern and north-eastern parts, requires additional outlays. Construction is considerably more expensive in the East than in the European part of the USSR (by 20-40 per cent). Large capital investment is needed in new cities to build the infrastructure—power networks, roads, auxiliary production, housing and

social amenities. Transportation is also more expensive, particularly during construction and initial use when many items, both for production and consumption purposes, have to be brought from the western regions. There is a constant shortage of manpower in the eastern regions, and population migration is sometimes making the situation even worse. In spite of this shortage, however, not only the fuel and raw-material industries with a high degree of mechanisation are developing in the East, but also branches of the manufacturing industry, engineering and the chemical industry that require highly skilled workers.

Far-reaching measures must be taken to ensure that the considerable effect that can be achieved from development of industry in the eastern areas is fully realised. In particular, planning of the development of productive forces in the East and other new industrial areas must ensure that this development is comprehensive. Industrial complexes can be based on the power industry (the Angara and Yenisei complex), ferrous metallurgy (Urals and Kuzbas, Taishet), non-ferrous metallurgy (Norilsk) or agriculture (Northern Kazakhstan). The complexes on the Angara, in the Sayany Mountains, at Bratsk, and Tyumen and others require unified management of the entire complex, as well as joint, co-ordinated planning. The decision to create a complex must rest on a comparison of efficiency calculations of different variants based on their branch structure and scale. A study of the regions where complexes can be set up (regional planning) is extremely important if the right choice is to be made at the right time of the location for enterprises comprising the complex and the exact site for enterprises planned.

The following general data testify to the movement of industry to the East. In 1973, with a 14.7-fold increase in the overall volume of industrial output over 1940, that of industry in all the eastern areas was 19.3-fold, including 18.4-fold in the areas east of the Urals.

In comparison with 1940, the share of the eastern areas in the national economy has increased particularly sharply for such products as oil, gas, coal, steel and chemical fibres (the latter were not produced here previously at all), and also for the production of machine-tools, cardboard, fab-

rics and consumer durables such as radios, refrigerators and washing machines. Taking the areas east of the Urals alone, iron ore, sulphuric acid, mineral fertilisers, tractors and paper can be added.

The future will see a significant increase in the share of the eastern areas. Strip-mining of coal will develop at a fast rate, particularly on the Kansk-Achinsk field and also in Ekibastuz, Kuzbas, and later in the more northern regions. The share of Western and Eastern Siberia in oil extraction is increasing sharply. Gas will also be extracted in ever increasing quantities in the eastern areas—in northwestern Siberia and Yakutia. The mining of iron ore will develop in these regions too, to which end the eastern Urals must be surveyed. The mining of iron ore from Siberian deposits that have already been surveyed will also increase. The share of the eastern regions in timber supplies will expand. Engineering, the chemical, light and food industries will develop at a faster rate. The construction of housing, the development of municipal services, transportation and the service industry will be of great importance in stimulating a population inflow into the eastern regions from the other parts of the country.

The comprehensive development of the new regions makes it possible to raise the efficiency of the relocation of industry to the East and will act as a new stimulus to this.

CHAPTER XI

THE TASKS INVOLVED IN DEVELOPING AGRICULTURE

1. AGRICULTURE: SPECIFICS AND GROWTH

Soviet agriculture is a branch of the economy the development of which determines the growth rate of the entire economy. A highly developed agriculture is an integral part of the material and technical base of communism. The Communist Party devotes considerable attention to the further advance of this branch of the economy. The problems that face the country will take considerable time to solve, and substantial efforts on the part of the working people of both the town and the countryside. Agricultural production must grow at a rate that will allow the demand for agricultural produce to be fully satisfied, the problem of the transformation of the countryside to be solved and the dependence of cultivation on random natural forces to be reduced to a minimum.

During recent five-year-plan periods, agriculture has been greatly developed. Before the Revolution, the gross product of agriculture for 1909-1913 averaged 28,100 million rubles a year, while in later years the figures were as follows: 35,700 million rubles for 1946-1950, 59,900 million for 1956-1960, 80,300 million for 1966-1970. In 1971, the output of agriculture reached 87,900 million rubles, but in 1972 and 1975, as a result of extremely unfavourable climatic conditions, dropped to 84,300 and 89,200 million rubles. In 1973 it reached 97,900 million rubles, and according to the plan for 1977 will increase to 126,500 million rubles.

Agriculture is developing considerably more slowly, however, than industry. The share of agriculture in the gross social product in 1973 was 15.8 per cent, i.e., only a quarter of that of industry. It accounted for 21.4 per cent

of the national income[1] though employed only four million fewer workers than industry. This means that in 1973, each worker in industry contributed 14,900 rubles to the gross social product, while each worker in agriculture accounted for only 4,300 rubles.

All these inconsistencies are the result of an imbalance between the development of industry and agriculture that took shape over several years during the course of industrialisation. In recent years, fewer resources have been channelled into industry, and investment in agriculture has greatly increased. Thus, the share of agricultural production investment in total investment increased from 11.7 per cent between 1946 and 1950 to 15.4 per cent between 1961 and 1965, 17.0 per cent between 1966 and 1970 and 19.9 per cent in 1971-1975.

This investment is helping to increase the technological level of agriculture, but is not yet sufficient to eliminate its lag behind industry.

Agriculture still depends to a great extent on weather conditions for the harvest and therefore for the productivity of livestock-breeding. Fluctuations in the harvest give rise to difficulties in supplies and affect the production of consumer goods, 75 per cent of which are of agricultural origin. They also have a bearing on the balance of demand and supply and on the foreign trade balance. They exert a considerable influence on labour productivity in agriculture.

Just as in other branches of the economy, labour productivity in agriculture is taken as the volume of production divided by the time worked. The actual volume of output might be greater or smaller, however, depending on the number of sunny days, rainfall, wind, etc. This causes changes in labour productivity. From 1961 to 1975, the

1961	6	1965	—2	1969	—1	1973	18
1962	3	1966	12	1970	12	1974	—2
1963	—7	1967	4	1971	3	1975	—7
1964	19	1968	7	1972	—4		

[1] These figures are for output, both gross and net, at current prices, relatively low in comparison with the value of agricultural produce. Calculation in value terms raises the share of agriculture in the national income (see *The National Economy of the USSR in 1973*, p. 604).

productivity of labour in agriculture changed as follows (as per cent of the previous year):

The growth of labour productivity is a result of technological progress in agriculture, the amount of machinery available, the use of fertilisers, the amount of power available and of electricity used and so on. An increase in the qualifications of the labour force, their skills and experience, improvement in the organisation of labour and living conditions in the countryside are also of great importance.

At the same time, these figures reveal a considerable year to year fluctuation in labour productivity: some years it increased by 12, 18 or 19 per cent, while other years it was only 1 or 3 per cent, or dropped by 2, 4 or 7 per cent. This is obviously the result of harvest fluctuations due to differences in weather conditions, and not of any factor inherent in production itself.

The dependence of agriculture on the whims of the weather must be eliminated, but for this a whole series of measures are required that will help bring agriculture up to the contemporary industrial level. Here we have in mind mechanisation, irrigation, the use of fertilisers, selection, the production of feeds and other measures to make the harvest stable.

If there is to be any substantial increase in agricultural production to meet the needs of the population, an increase in the technical level of agriculture is required. This can only be achieved given a steady increase in labour productivity, under conditions of a regular drop in the numbers employed in agriculture and even the agricultural area might decrease when land is withdrawn for other purposes. Considerably more agricultural produce must, however, be obtained from the present area. For this, the grain yield must be increased, as at the moment it is only half the level in developed European countries and the USA. The productivity of cattle-breeding must also be raised, as it is now 30-50 per cent lower than in these countries. The USSR boasts vast plains and black earth, but the climatic conditions in the country are worse than in Western Europe and the USA: it is colder and there is less rainfall. On the other hand, Soviet agriculture has all the advantages of the socialist economy of which it is an integral part.

As a result of the socialist restructuring of agriculture since the Revolution, it is now made up of large and powerful enterprises. On January 1, 1976 there were 29,000 collective farms in the USSR (in 1965 there were 36,900). Not counting the 500 fishing collective farms, per collective farm there are 465 households, 524 collective-farm workers, 6,300 hectares of agricultural land, including 3,600 hectares of arable land, 1,664 head of cattle, 37 tractors, 10 combine harvesters and 18 motor vehicles. There are 18,064 state farms (11,700 in 1965) with an annual average of 568 employees, including 442 workers, 18,900 hectares of agricultural land, 5,900 hectares of arable land, 2,000 head of cattle, 57 tractors, 20 combine harvesters and 26 lorries. These figures show how large collective and state farms are. In recent years, the number of collective farms has been dropping, but they are becoming larger and richer, the machines they have at their disposal are growing steadily in numbers, as are their incomes, and some have been turned into state farms. The number of state farms has been increasing. On the average they have more machinery at their disposal than collective farms, though in recent years their agricultural area has somewhat decreased.

As agriculture develops, both collective and state farms will become more powerful, productive and efficient enterprises, with advanced machinery and large resources at their disposal. The indivisible fixed and circulating assets of collective farms are growing. From 1960 to 1975 the increase (for a comparable group of collective farms) was 247 per cent to 91,700 million rubles. This means that an average collective farm has about a 3.2 million worth of indivisible assets and a gross income of some 790,000 rubles per annum. Collective farm workers are paid a direct monetary wage. All this reduces the differences between the two forms of socialist property in agriculture—state and co-operative (collective farm)—and furthers their future amalgamation into a single, national property.

Major comprehensive programmes, such as measures on the further development of agriculture in the non-black-earth zones of the RSFSR, covering 29 regions and autonomous republics, will have a major role to play in the future advance of agriculture. In order to raise the efficiency of

agricultural production, develop all its branches on the basis of specialisation and concentration, and transfer them on to an industrial basis, large supplies of fertilisers, tractors, combine harvesters, and motor vehicles to collective and state farms, soil drainage and irrigation, soil liming, cultivation of high-yield varieties of plants and raising of highly productive breeds of cattle and poultry, the construction of cattle-breeding complexes and farms, and poultry farms, the development of agro-industrial complexes, light and food industry enterprises, warehouses and vegetable storage facilities, and the building of road networks are envisaged. A broad programme has also been outlined for the construction of housing and social amenities, the transformation of rural centres and villages into well-appointed settlements and the resettlement to them of people from small inhabited localities. 35,000 million rubles will be allocated for these purposes. It is extremely important that agriculture be developed on a comprehensive basis, with mutual co-ordination of its branches, and also in co-ordination with the development of industry, transport, trade and the non-productive sphere.

2. THE TASKS INVOLVED IN DEVELOPING CROP-GROWING

The major task in crop-growing is to raise considerably the yield of all agricultural crops, particularly of grain crops, by further mechanisation of crop-growing, increasing the numbers of tractors, combine harvesters, motor vehicles and other agricultural machines.

Since the Revolution, a vast number of agricultural machines have been built. In 1975, collective and state farms had 2.3 million tractors at their disposal, or four times more than in 1940, and 80 times more than in 1928, 680,000 grain combine harvesters and 1.4 million motor vehicles. This does not, however, satisfy the demand. Four times as many tractors and about 2.5 times as many combine harvesters are needed. About 1,500 different types of agricultural machine, equipment and device are required, while only 1,000 types are produced. During the Ninth Five-Year-Plan period, the number of tractors grew by 359,000 (1.7 million were delivered, including those intended as replace-

ments), and agriculture received 450,000 combine harvesters (grain) and 220,000 lorries.

The changes in the technical level of agriculture are not confined to a purely quantitative increase in agricultural machinery and equipment. They are accompanied by an increase in quality and reliability of all types of equipment supplied to agriculture, the development of highly productive progressive types of agricultural machinery and modernisation of existing equipment. High-speed tractors with up to 275 h.p., all-purpose machines with a wide coverage of many rows, equipped with an array of tractor-mounted hydraulically powered implements, and the like are the most promising types of machinery.

The increase in the quantity of such machinery allows many hard jobs to be mechanised and speeded up, and their quality improved. In turn, this helps raise the yield of agricultural crops and the productivity of cattle-breeding.

In this way, agriculture is receiving increasing amounts of modern machinery and is raising the level of mechanisation of production processes. However, it is not yet fully equipped with specialised machinery and implements for the successive mechanisation of each stage in the production process or for mechanisation on a comprehensive basis.

Agriculture has more fixed assets per unit of the net product received from agriculture (at current prices) than industry (2.02 rubles in industry and 2.76 rubles in agriculture), but significantly fewer if the national income is assessed according to value rather than price. The assets-worker ratio in agriculture is also considerably lower than in industry: 6,000 rubles per worker in agriculture against 11,300 in industry, although it should be higher in agriculture than in industry considering that, as already mentioned, machines are not used throughout the calendar year in agriculture. The shortage of machinery due, for example, to delays in repair work or poor quality or shortage of machinery can drag out agricultural work and result in considerable losses. Harvesting, for instance, should take 7-10 days. A delay of 12 days in gathering in the harvest results in a loss of 13-15 per cent of the grain, while 20 days mean that a third of the harvest is lost. Early ploughing increases the

harvest by 20-30 per cent in comparison with late ploughing. A delay of a few days in harrowing in the southern steppe regions results in the loss of vast quantities of water and reduces the yield.

An important line of technological progress in agriculture, a condition for increasing the yield, is the use of chemicals in agricultural production. The accelerated development of the chemical industry in recent years has made it possible to substantially improve the supplies of mineral fertilisers and agricultural chemicals.

In 1950, 1.2 million tons of mineral fertilisers, in terms of 100 per cent content of active ingredient, were produced, while the figures for 1960 and 1975 were 3.3 million and 22 million tons, respectively. The output of herbicides, chemicals, micro-fertilisers, antibiotics and other chemical products supplied to agriculture is on the increase. These are being used increasingly widely to protect plants in the battle against weeds, pests and plant and animal diseases and to stimulate the growth of plants and animals. However, the amount of chemicals used in agriculture does not satisfy the need. The supply of fertilisers to agriculture was 13.8 million tons[1] in 1975. In 1975, the average amount of fertiliser used per hectare of arable land was 77 kg against 99 kg in the USA (1974), 393 kg in West Germany, 441 kg in Japan, 308 kg in France, 261 kg in Britain, 376 kg in the German Democratic Republic, 275 kg in Czechoslovakia, 243 kg in Hungary, 224 kg in Poland and 140 kg in Bulgaria. Fertiliser is used on the smallest scale in grain growing areas, while the bulk goes to cotton, beet-root, grapes and other industrial crops. This can be judged indirectly from the amounts of fertiliser used per hectare of arable land in the Union Republics. In the RSFSR, for example, where the share of grain crops is particularly high, 59 kg of fertiliser were used per hectare of arable land in 1975, while the respective figures for other republics were as follows: 112 kg in the Ukraine, 189 kg in Georgia, 148 kg in Armenia, 238 kg in Uzbekistan, 241 kg in Turkmenia, 220 kg in Tajikistan, 238 kg in Estonia and 221 kg in Latvia.

As a result of large quantities of fertiliser being used in areas where industrial crops are grown, the yield of these

[1] See *The National Economy of the USSR in 1975*, pp. 384 and 386.

has increased to a fairly high level. The cotton harvest in the USSR in 1975 was 2.69 tons per hectare, which is substantially above the Egyptian, Sudanese, US and Mexican levels. The sugar-beet harvest was 24.7 tons per hectare in 1973, less than in other European countries but 70 per cent more than that in the USSR before the last war. It has been calculated that the use of fertilisers developed for specific soils and crops raises the harvest to a level at which the increase in the harvest far outweighs the outlays on fertilisers and spreading.

In the future, the supplies of fertilisers will increase substantially and by the end of the century will reach 300-350 kg per hectare of arable land (i.e., six to seven times more than in 1970). This will make it possible to supply all industrial crops with as much mineral fertiliser as required and to increase the amount supplied to grain and feed crops substantially.

Irrigation and drainage work is of great importance for the further development of agriculture and for increasing the fertility of the soil. It is a major means for ensuring stable, guaranteed harvests under the unfavourable climatic conditions of a considerable part of the USSR.

At the present time, the area of irrigated land is more than 14 million hectares and of drained land the same. Together, this means more than 12 per cent of all arable land.

In the near future, the USSR will considerably expand irrigation and drainage work. Tens of millions of hectares of land must be irrigated in Central Asia, Kazakhstan, Transcaucasia, the Ukraine, the North Caucasus and in the areas lying on both sides of the Volga, and large areas must be drained in the North-West, Byelorussia, the Baltic republics and the Ukraine. This work requires enormous capital investment: about 4,000-7,000 rubles to irrigate and 20-30 per cent less to drain a hectare of land. During the Ninth Five-Year-Plan period, 3.4 million hectares of irrigated land came under cultivation, and 3.4 million hectares were drained. It is planned in the future to increase the area of irrigated and drained land to 48 million hectares, including up to 21 million hectares under irrigation and up to 27 million hectares of drained land. Capital investment in land improvement schemes might, in the future,

constitute as much as 20 per cent of the overall capital investment in agriculture (48,000 million rubles in 1976-1980). Current outlays of about 100-150 rubles per hectare a year are required to maintain irrigation and drainage installations. The quality of these installations is of major importance, as this determines their efficiency and the reduction of water losses through filtration and evaporation. The best results are achieved when the earth canals are lined with filtration-proof concrete or when canals are replaced by gutters and pipes. This not only raises the efficiency, but also eliminates the considerable drawbacks of canal-type irrigation systems, such as salination of the soil as a result of filtration and a rise in the ground water level. Drainage is more efficient when it is well below the surface.

Considerable capital investment will be made in the irrigation of pastureland. The area of irrigated pastureland must be substantially increased in Kazakhstan and also in Central Asia.

Farming on irrigated land increases the harvest of grain, sugar-beet and other crops by 50-100 per cent depending on how well the land is farmed, and although the production costs per ton of produce rise somewhat, the net income rises as a result of the overall growth in the volume of output.

An increase in the yield of grain crops depends largely on achievements in selection, the use of high-yield and frost-resistant varieties suited to conditions in the USSR.

The mean annual yield of winter wheat in the USSR rose from 1.01 tons per hectare in 1940 to 1.51 tons in 1960, 2.28 tons in 1970 and 2.69 tons in 1973, while the figures for spring wheat are 0.66 ton per hectare in 1950 rising to 0.95 ton in 1960, 1.23 tons in 1970 and 1.34 tons in 1973. The average rice-yield rose from 1.73 tons per hectare in 1940 to 1.97 tons in 1960, 3.65 tons in 1970 and 3.61 tons in 1973, while the respective figures for maize, beginning in 1960, are 1.38 tons, 2.8 tons and 3.33 tons. This increase in yield is connected to a considerable extent with the introduction of new varieties. A further expansion of plant selection work is planned. Also of major importance are measures to strengthen the material and technical base of seed-growing in order to raise the quality of grains (mechanised seed classification, drying and storage).

An increase in yield is the combined result of all the factors mentioned above—the use of modern machinery, an increase in the quantity and quality of fertilisers, irrigation, selection work, and also rational and efficient management. A combination of all these factors ensures an increase in grain production with smaller numbers of workers being employed in agriculture.

It has been estimated that, to satisfy fully the demand for grain to feed the population and livestock, an average of 1 ton of food and feed grain must be produced per head of the population (against the current 0.7-0.8 ton). This means that, with the current population and sown area, grain production must reach the 250-million-ton level, or 11.2 per cent higher than in 1973. For this, the average yield of all grain crops must be raised from 1.76 tons per hectare in 1973 to 1.97 tons. In the future, with an increase in the population to 290 million, the yield must be raised to 2.3 tons per hectare. This increase in yield necessitates the measures mentioned above to improve the supply of machinery to agriculture, increase deliveries and improve the quality of fertilisers, carry out land improvement and selection, and improve the organisation of grain production. The 25th Congress of the CPSU set the task of bringing the average annual grain harvest up to 215-220 million tons during the Tenth Five-Year-Plan period.

The production of other crops to provide the population with a rational diet will increase even more than that of grain. The production of fruit rose from 1960 to 1973 by almost 200 per cent and the per capita output is now about 70 kg against 23 kg in 1960.

The production of vegetables and melons was 23 per cent higher in 1973 than in 1960 and amounted to 100 kg per head of the population.

In order to increase the output of fruit and vegetables, the area under fruit and hot-house vegetable-growing is being extended and the capacity of storage and refrigerating facilities and fruit and vegetable-processing plant is being expanded.

The yield of industrial crops—raw material for the light and food industries, such as sugar-beet, sunflowers, potatoes, soya beans and flax—will be substantially raised and

their production will increase. In 1975, the production of cotton was about 7.0 million tons. This increase was made possible by the introduction of high-yield and viable strains of cotton and by an increase in the level of mechanisation in the cultivation and harvesting of cotton.

3. LIVESTOCK-BREEDING

There are considerable tasks facing livestock-breeding. In the number of cattle, over 111 million head, the USSR is third to the USA (132 million head), and India (177 million) exceeding such cattle-breeding countries as Brazil, Argentine and Australia. The number of pigs in the USSR is about 57 million. In the number of sheep (141 million) the USSR holds second place after Australia (163 million). Even so, livestock-breeding does not yet satisfy the country's demand for foodstuffs of animal origin.

Although it has increased, the productivity of livestock-breeding is not high enough. For example, the output of beef per head of cattle has increased from 44 to 56 kg, but is less than in the USA, where it was 97 kg in 1972. In 1972, the output of pork per pig in the USSR was 76 kg, and in 1975, 2,350 kg of milk were obtained per cow.

The 25th Congress of the CPSU set the task of bringing the average annual output of meat up to 15-15.6 million tons (slaughter weight), of milk up to 94-96 million tons, and of eggs up to 58,000-61,000 million.

A reliable way of rapidly increasing the output of animal products is to develop the preparation of fodder and improve its quality. During the Ninth Five-Year-Plan period, the mixed feeds and microbiological industry developed at a fast rate and mixed feeds began to be produced on collective and state farms. The production of mineral additives has been increased substantially and wider use is being made of the waste from the food, meat-packing and dairy industries as cattle feed.

It is extremely important not only to raise the overall output of fodder, but also to produce more concentrated mixed feeds, including proteins, amino-acids, trace elements, vitamins, mineral additives and, finally, preserva-

tives to ensure that they will not deteriorate in the period between production and consumption. So it is not a question simply of mixing four to five components, but of the special production of complex feeds using the waste of the food industry, such as skim milk, oil-cake, sugar-beet residues, nutrient yeasts, various chemical substances, and so on. The production of mixed feeds necessitates the establishment of a special branch of industry, with enough capacity to satisfy the requirements of developing livestock-breeding. A significant increase in the production of fodder is particularly efficient when it provides the opportunity to use the waste from the food and other industries.[1]

Livestock-breeding is the least mechanised branch of agriculture and more than half the overall expenditure of labour in agriculture is used here. In order to speed up the growth of livestock production, the state is investing large sums in mechanisation of the branch. As a result, the mechanisation of cow milking rose from 27 per cent in 1965 to 83 per cent in 1975; of the water supply on cattle farms rose from 53 to 81 per cent, and on pig farms from 65 to 95 per cent. There are as yet few mechanisms used to supply feeds: in 1975 their share was 29 per cent on cattle farms and 60 per cent on pig farms. The mechanisation of barn cleaning gained impetus: on cattle farms it increased from 9 to 56 per cent and on pig farms, from 12 to 80 per cent.

[1] The foreign press has published interesting data on obtaining feed proteins from cow manure. The cow assimilates no more than 20 per cent of the nutritious substances that it eats. The remainder could be extracted. For this reason, manure is considered a too valuable substance to be used as fertiliser, let alone fuel. The American company Sieres Land which keeps about 60,000 head of cattle has spent 15 years on research and experimentation into the extraction of protein from cow manure, and it now considers the problem solved. Comparatively simple mechanical and chemical processes for cleansing and fermentation produce a green powder with a smell reminiscent of that of corn silage, with an approximately 8 per cent protein content. A concentrate of grey colour contains about 25-30 per cent of protein, which is comparable with the 44 per cent protein content of soya-bean flour and the 70 per cent protein content in fish flour. In the USA, 1,700 million tons of livestock waste could be collected per annum, three quarters of which consist of cow manure. If only a third of this is used, as much protein can be obtained as is contained in the annual soya-bean harvest.

The mechanisation of sheep-shearing reached 89 per cent. The amount of power used in livestock-breeding must be substantially increased, as it is at present much lower than in crop-growing—an average 16.8 h.p. per worker. Most of agriculture's available power is concentrated in crop-growing.

So there have been certain advances in the mechanisation of livestock-breeding in recent years. The construction of mechanised livestock units on collective and state farms is continuing with the aim of speeding up the growth of the output of this branch and raising its efficiency. The mechanisation of farms depends on both the supply of equipment from industry and the initiative of these units themselves, for example in the water-supply section, cleaning and the like.

The mechanisation of all farms would require enormous expenditures. Furthermore, on small farms, the use of many up-to-date pieces of equipment would be inefficient. On a small dairy farm with 300 cows, for example, the silage loader works no more than 40 minutes a day, the feed deliverer no more than two hours and the milking machines are used at 25-30 per cent of capacity.

For this reason, near towns, large-scale state, collective and inter-collective farm complexes operating on an industrial basis, and also poultry factories are being set up. Large complexes raising 2,000-10,000 cows or 100,000 pigs are already in operation. Others are under construction in the Moscow and Leningrad regions, in the industrial areas of the Ukraine, the Urals, Siberia, Central Asia and Transcaucasia. These complexes are highly mechanised and operate with advanced equipment that is used far more fully and efficiently than on small farms, and capital investment per unit of output is reduced. Complexes of an industrial type provide all the benefits of large-scale production. This is evident, for example, from such complexes as that on the Voronovo state farm near Moscow, the Novy Svet pig-breeding complex in Leningrad Region, the Kazatskaya Steppe state farm in Belgorod Region and the Kalityansky state farm in Kiev Region, and others.

Thanks to the higher standard of the technical equipment in such complexes, the weight of cattle is 25-30 per cent

higher than in smaller units, the average daily weight gain of pigs is 50-100 per cent higher and the farrow 100 per cent greater. As a result of these advantages, the production costs of output in complexes are nearly 35 per cent less than on farms, and the labour expenditure considerably less. The industrial production of broiler chickens, which is cheaper than poultry-breeding on farms, offers considerable advantages. The production of broilers has increased, but its share in the production of poultry is still very small.

The creation of large-scale poultry farms was largely instrumental in raising the poultry population by almost 50 per cent from 1965 to 1975, raising the egg output from 29,068 million in 1965 to 57,463 million in 1975. Thanks to this, there was an almost 220 per cent increase in the sale of eggs to the population through the state and co-operative trade networks.

In livestock-breeding complexes of an industrial type, the living and working conditions are better than on farms. Urban-type settlements can be provided with all amenities.

4. THE ALL-ROUND DEVELOPMENT OF AGRICULTURE

One of the main conditions for a further development of agriculture is to guarantee that it is comprehensive in nature. The implementation of this principle is an important task for management within the production unit, in inter-farm links, and on the inter-branch and national level.

Integration within the production unit arises from the very multi-branch nature of agriculture. Land cultivation is linked with livestock-breeding, as it supplies the latter with cattle feeds and receives manure to fertilise the fields. Although agriculture does specialise according to the soil, climate and other factors, zone, region and individual farm, which ensures all the advantages of specialisation (homogeneity and large scale of production), a combination of land cultivation and livestock-breeding in various forms almost always proves efficient.

Furthermore, an important task in ensuring integration is to combine agricultural production with industry and

construction at all levels. The creation of agro-industrial associations will help to eliminate the difference between town and country. The CPSU Programme envisages that "agrarian-industrial associations will gradually emerge wherever economically expedient, in which, given appropriate specialisation and co-operation of agricultural and industrial enterprises, agriculture will combine organically with the industrial processing of its produce".

Depending on the specialisation of collective farms, it is efficient to set up subsidiary hulling and milling, oil and fat, fruit and vegetable and wine-making enterprises. Many collective farms have building material producing, sawmilling and timber-processing plants. Auxiliary industrial enterprises of these types should also be set up on state farms. Table 33 gives the numbers of subsidiary enterprises of joint management of state and collective farms in 1970 and 1975.

Table 33

Number of Interfarm Enterprises and Organisations Belonging to State and Collective Farms in 1970 and 1975

	1970	1975
Total interfarm enterprises, organisations and associations	4,554	6,327
Shareholders (collective or state farmers, other state or co-operative enterprises and organisations	68,534	94,087
Interfarm enterprises active in specific fields	4,255	6,086
building	2,432	2,739
building materials	146	141
forestry	288	465
silage	77	415
processing of farm products	14	29
animal breeding	272	591
poultry farming	574	556
artificial insemination	57	194
diversified enterprises	299	241

These branches of industry on state and collective farms must be developed further to help increase the production of agricultural raw materials and cut down losses. Capital investment and supplies of building materials, equipment and construction workers are required for these purposes. At the present time, more than 36 per cent of all the investment in agriculture comes from the collective farms and a substantial proportion of construction is carried out by the farms themselves. Inter-collective farm associations and organisations may be of some importance in this work. In 1973, there were more than 2,700 inter-collective farm construction organisations and about 160 such organisations for the production of building materials. Moreover, regional, district and republican associations for the management of inter-collective farm organisations have 550 construction and assembly boards, construction boards and mobile mechanised teams, and also 488 enterprises producing building materials. The advantage of the inter-collective farm enterprises is their relatively large scale in comparison with enterprises on individual collective farms and hence their large economic potential.

Inter-collective-farm associations and organisations also exist for other types of production activity—poultry factories and poultry farms (of which there were 574 in 1973), livestock-feeding centres (358), feed production plants (287), wood-processing units and forestries (397), and others.[1] The development of inter-collective-farm enterprises reflects a new stage in the socialisation process in agriculture that gives co-operative and collective-farm ownership a social nature.

The development of inter-collective farm associations produces a considerable economic effect. A large scientific-production association was set up in Moldavia, for example, where there had been 4,000 small farms. The association was made up of 160 modern inter-collective-farm enterprises and organisations for the production of meat, milk, eggs and raising of young cattle. 220 million rubles have been invested in the material base of these inter-col-

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[1] See *The National Economy of the USSR in 1973*, p. 464; *The National Economy of the USSR in 1975*, pp. 422-430

lective farm enterprises, and the profits have already far outstripped this investment, their output constituting a substantial part of the overall volume of meat production in the collective-farm sector. Another example is the inter-collective farm orchard in Slobodzeya District that was laid out in 1970. This orchard runs along the Kishinev-Odessa highway for more than 30 km. It is planned that it will eventually cover 6,000 hectares and yield 200,000 tons of fruit a year. The orchard complex also contains refrigeration units, a packing base, mobile refrigerators.

The comprehensive development of agro-industrial associations is also proceeding within the state sector, where it is based on a high degree of production specialisation, its expansion on a modern technical base and increasing skills of the workers. All this makes it easier to set up state factory farms. In Moldavia, two-thirds of state farms are amalgamated with processing plants, including fruit and vegetable, wine-making, essential-oil and dairy state factory farms within territorial production agro-industrial associations. Kotovskoye is an example of such an amalgamation: it consists of 11 state factory farms, with a total area of 23,000 hectares and 41 million rubles of fixed productive assets. The main output of the association is grapes and industrial products made from them. Land not suited for vineyards is used to grow feed crops. The association also produces meat and milk on specialised state-collective farms. Thus a unified agricultural reproduction process is ensured in industrial enterprises with a full closed-circuit production cycle.

In the USSR as a whole, there are more than 70 agro-industrial associations, which amalgamate state farms and factories processing agricultural raw materials. One of them, Donkonserv, for example, is made up of 11 vegetable-growing state farms and four canning plants, and the Konservplodovoshch association in the North Caucasus includes nine fruit- and vegetable-processing plants, four canning plants, and a trading enterprise with a retail network.

Now let us turn to the extent to which agriculture has been amalgamated with industry on the national level, i.e., agro-industrial integration on a country-wide scale.

The Communist Party and the Soviet state have always

based their economic policy on a combination of agriculture with industry. The implementation of the concept of agro-industrial integration on a country-wide scale is connected with the significance that is attached to a balanced development of agriculture and industry, their interdependence and full reciprocal satisfaction of each other's needs.

Agro-industrial integration implies, on the one hand, the development of the branches of industry supplying agriculture with machinery and equipment, fertilisers and the means to protect crops, electricity and so on, that is, the development of agricultural engineering, the chemical industry, the electric power industry, including power transmission lines, and other industries supplying agriculture. Agriculture's annual needs for these types of output must be determined, as must the volume of investment required in industrial development and the efficiency of this investment. Furthermore, agriculture requires development of the construction industry and the production of building materials (not counting local ones) for the construction of large buildings and other installations, including irrigation and drainage schemes. The construction of elevators, warehouses and refrigerators is of major importance, as without these the agricultural produce cannot be stored. Also essential is the construction of roads, above all the local road network directly serving the collective and state farms, as this will ensure transportation of industrial products and agricultural produce.

Agriculture's needs for means of production must be calculated on the basis of the planned volume of agricultural produce, taking account of the possibility of plan overfulfilment as a result of a good harvest. If these requirements are underestimated, agricultural produce will be lost. It is not difficult to calculate the capital and current costs required to satisfy fully the production needs of agriculture and compare them with the losses suffered by the country from the shortage of machinery, chemicals and electricity in agriculture and the shortage of transportation facilities, processing and storage capacity for agricultural produce, as a result of which there are direct losses of the output already produced.

On the other hand, the agricultural units within a complex supply industry, trade and towns with the agricultural materials and finished products they require for processing and consumption. The country's needs for agricultural produce must be taken into account in order to determine the production plan and so must the measures that agriculture and industry themselves must take to ensure fulfilment of the plan. The links between agriculture and industry are not confined to this alone: apart from the movement of materials and produce and their exchange, a movement of values also takes place in the form of mutual transfers for output provided, taxes, capital investment, and so on. Population movements, migration to towns from villages and from agriculture into industry, and from one part of the country to another, should also be noted.

The development of agriculture at the present stage is taking place in conjunction with a steady drop in the numbers of hands employed in this sector as they move to the towns.

From 1959 to 1970, 16.4 million people moved from the countryside into towns, i.e., an average of 1.4 million people a year. In spite of this considerable outflow, the rural population dropped by only 6.3 million, as the outflow was compensated for by the natural population growth in rural areas. The share of rural population of the country is 38 per cent of the total population, which is substantially above the corresponding percentages for the developed capitalist countries. It is 19 per cent in West Germany, 23 per cent in Sweden, 26 per cent in Canada, 27 per cent in the USA, 28 per cent in Japan and 30 per cent in France. The numbers employed in agriculture in 1913 were 49.5 million, 36.3 million in 1940, 33.2 million in 1950, 32 million in 1960, 29.2 million in 1970 and 28 million in 1975, including 4.6 million members of families engaged in subsidiary activities. The drop in the numbers employed in agriculture is mainly in the lower age groups, which has led to a rise in the average age of agricultural workers. In recent years, thanks to measures to develop agriculture and make work in the village more attractive, the outflow of young people has slowed down substantially, particularly in those parts of the country where industry's requirements for

Table 34

The Mean Annual Number of Workers on Collective and State Farms, in Subsidiary and Other Productive Agricultural Enterprises[1]
(in million)

	1940	1950	1960	1970	1975
Total labour force employed on all collective and state farms, and in subsidiary and other productive agricultural enterprises	31.3	30.9	29.4	26.8	26.4
Including:					
on collective farm (excluding private plots)	29.0	27.6	22.3	17.0	15.4
on state farms and in subsidiary and other productive agricultural enterprises	1.8	2.6	6.7	9.8	11.0
on machine-and-tractor, and repair stations	0.5	0.7	0.4	—	—
Workers drawn from other enterprises to work on collective and state farms	0.1	0.2	0.5	0.6	1.0
Of the total number of workers employed in agriculture	28.1	27.9	26.1	23.8	23.5

new workers are limited. Major factors regulating the population migration from the countryside to the towns is the further development of productive forces in agriculture, the decreasing differences between agricultural and industrial labour, and the rise in the standard of living of the rural population.

There was a particularly rapid drop in the numbers employed on collective farms in the 1950s and 1960s (by 10.6 million) when many collective farms were reformed into state farms and the overall number of collective-farm households dropped by 29 per cent. At the same time, there

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[1] See *The National Economy of the USSR in 1975*, p. 440.

was a considerable increase in the numbers employed on state farms, in subsidiary and other agricultural enterprises.

While there is a general drop in the numbers employed in agriculture, the number of trained workers has risen, as Table 35 shows.

Table 35

The Number of Secondary and Higher School Graduates Employed in Agriculture (thousands)

	Jan. 1, 1941	July 1, 1953	Dec. 1, 1960	Nov. 1, 1965	Nov. 16, 1970	Nov. 14, 1975
Total on all collective and state farms and in other productive agricultural enterprises	50	114	406	519	821	1,207
Including:						
agronomists, animal specialists, veterinary surgeons	34	96	294	359	489	641
On collective farms . . .	29	83	222	232	390	548
Including:						
agronomists, animal specialists, veterinary surgeons	19	69	161	165	234	297

The increase in skilled hands working in agriculture is large, but still not sufficient and their proportion is still small, if one recalls that the total number of secondary and higher school graduates in the national economy was 22.8 million in 1975 and the number of agricultural specialists graduating from higher and specialised secondary schools in 1973 alone was 240,600. By comparing these figures with data on the growth of the numbers employed, it becomes clear that there are very large numbers of agricultural college graduates who are working in other fields. In order to eliminate this undesirable trend more rural dwellers

must be admitted to agricultural colleges and material incentives must be created to encourage graduates to work according to their speciality.

5. ERASING THE DIFFERENCE IN LIVING STANDARDS IN TOWN AND COUNTRY

An important task involved in the further development of agriculture is to eliminate the difference between town and country and between industry and agriculture. This is one of the conditions for improving socialist production relations and their development into communist relations. The main way to solve this problem is to bring agriculture up to the level of industry in terms of the amount of machinery available and the organisation of production, to raise the degree of socialisation of agricultural labour and turn it into a form of industrial labour, to bring together and merge the two forms of socialist ownership into a single communist form, to erase the class differences between workers and peasants, and the differences between town and country in the sphere of culture and daily life. The guarantee that these differences will disappear lies in the all-round development of the productive forces in the countryside. The technical re-equipment of agriculture, its industrialisation and the creation in the countryside of manufacturing and other enterprises will speed up the transition to a system of machines, to integrated mechanisation of all links in the production process in land cultivation and livestock-breeding. The quantitative and qualitative growth in the material and technical base of agriculture will erase the differences in the technical equipment of labour in the town and countryside.

New machinery and production processes in agriculture make it necessary for the workers to be highly skilled. Apart from the technical professions that appeared in the countryside during the first years of collectivisation (tractor-drivers, combine-operators, agronomists and others), nowadays electricians, mechanics, controllers, automatic production process operators and computer operators are also engaged in agriculture, to say nothing of engineers, techni-

cians and workers in industrial enterprises. Modern agricultural work is more and more associated with creativity, the search for reserves for a growth in production and the surmounting of objective difficulties.

The welfare of the rural population is on the increase. The real incomes of collective farmers in 1975 were 480 per cent higher than in 1940, i.e., had grown faster than the incomes of factory and office workers over the same period (250 per cent). This brought the real incomes of collective farmers closer to the level of those of factory and office workers. It is characteristic that deposits in savings banks in the towns and urban-type settlements increased by 525 per cent from 1960 to 1975, while the increase in rural areas was 800 per cent. The average deposit in urban areas was 228 rubles in 1960 and 157 rubles in rural areas in the same year, while the figures for 1975 were 854 and 837 rubles, respectively. This is a result of the overall rise in the incomes of collective farms by 120 per cent over this period, the rise in the money earnings of collective farmers and the wages of state-farm workers, and the introduction of pensions for collective farmers, to say nothing of the growth in income from personal subsidiary plots.

Much has been done to raise the standard of living in the countryside. Almost all collective and state farms have electricity. During the Eighth Five-Year-Plan period every year, up to 2,500 schools for 900,000 pupils were opened in the countryside, pre-school establishments for 160,000 children, clubs and cultural centres, hospitals and clinics with 10,000-12,000 beds. The sale of cultural and recreational goods is on the increase: about 12 million watches and clocks, 2.3 million radios, 2 million TV sets, over a million refrigerators, 2.5 million bicycles, scooters, etc., are sold in the countryside annually.

Even so, the difference in the standard of living in the town and country is still great. Housing construction in the countryside is growing slowly: in 1975, for example, housing with a total area of 34 million m^2 was built in the countryside, against 51 million m^2 in 1960 and 110 million m^2 in the country as a whole.[1] Domestic services are mark-

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[1] See *The National Economy of the USSR in 1973*, p. 537.

edly less developed in the countryside than in towns, as are trade and transport. There are few roads that can be travelled throughout the year and the standard of cultural, educational and health services is much lower.

Considerable capital investment is required to provide a standard of living in the countryside to compare with that in towns. By present standards, capital investment in construction for a small town constitutes about 3,300 rubles per inhabitant. Half of this goes on housing, costing 150-200 rubles per m^2 (in Moscow the average rate is 210 rubles but is considerably less in small towns). The other half is spent on roads (a kilometre costs about 1,000 rubles), sewage and communications networks, public buildings, and so on.

In the future, the number of the rural population will fall substantially. If the 3,300 rubles average capital investment per capita is applied to the entire agricultural population, an enormous sum of over 300,000 million rubles is obtained, or more than double the sum invested in agro-industrial integration during the Ninth Five-Year-Plan period (132,000 million rubles). This sum must be reduced by the amount of fixed non-productive assets available in the countryside but these are not particularly large, and a considerable proportion of them does not satisfy the demands of contemporary Soviet man.

What is more, an increase in the standard of living of the rural population is not possible unless serious measures are taken on its resettlement. At the present time, 29,000 collective farms and 18,000 state farms embrace about 500,000 villages, i.e., about 10 per farm, on average. Only 15 per cent of collective farms have a single compact village. About 50 per cent have from two to five villages, while about 8 per cent have between 16 and 75 or even more villages. There are a large number of villages that consist of only a few households and the villages are sometimes situated within 10-15 km of each other.

This makes it far more difficult to organise trade, services, education and health services. Trade outlets, schools and hospitals cannot be built in every small village, while with the long distances and bad roads, particularly in spring and autumn, it is extremely difficult for the population of such

villages to use the establishments and enterprises that are situated in the bigger, central village.

This is why it is extremely important for rural inhabitants to be resettled in large villages. In certain regions this is already taking place, particularly in Moscow Region, where between 1966 and 1970, the inhabitants of 400 small villages were resettled in large, well-appointed centres. During the Ninth Five-Year-Plan period, the inhabitants of hundreds more villages were resettled. This not only helps to raise the standard of living in the countryside, but is also of major importance for increasing the area of agricultural land and developing agriculture in Moscow Region.

Major measures for attracting the population of small villages to well-appointed settlements are envisaged in the comprehensive programme for the development of the non-black-earth zone of the Russian Federation.

The resettlement of rural inhabitants to modern villages is a problem of enormous economic and social significance. The rational forms of resettlement of the rural population and the transformation of villages into modern urban-type settlements, with modern housing and amenities and developed services play a major role in raising the standard of living of the rural population, in raising the productivity of labour in agriculture, and in achieving the historical goal of erasing differences between town and country.

CHAPTER XII

THE TASKS INVOLVED IN DEVELOPING TRANSPORT

1. THE RATE OF GROWTH OF FREIGHT AND PASSENGER TRANSPORTATION

Accurate and smooth-running transport is to no small extent responsible for the efficiency of social production. In the USSR, 9.2 million people are employed in the transportation sphere. Freight transport holds an important place in social reproduction. Connected with all the other branches of material production, transport continues their production process by delivering their output to the consumer. Passenger transport is a means of intercourse between people, that facilitates management of the country and the economy, migration of the working population, tourism and holiday-making.

The freight turnover of transport is one of the factors of the development of production. In 1975, the total freight turnover of all types of transport in the USSR was 5,200 million ton-kilometres, i.e., about a sixth of the world total, and passenger transportation reached 747,000 million passenger-kilometres, or about 8 per cent of the world total. From 1976 to 1980, the turnover of all types of freight transport will rise by 32 per cent, and passenger turnover by 23 per cent.

It has been calculated that freight turnover grows at roughly the same rate as the national income. In 1970, for instance, freight turnover was 430 per cent of the 1950 level, while over the same period, the national income also rose by 430 per cent. In comparison with 1960, freight turnover and the national income in 1970 had both doubled, and in comparison with 1965, freight turnover was 38 per cent higher

and the national income, 45 per cent higher. In 1975, freight turnover was 36 per cent and the national income was 32 per cent above the 1970 level. It is also possible that, in the future, the growth of freight turnover will continue to be roughly the same as that of the national income.

The distribution of freight turnover between the different forms of transport has changed substantially over the years of Soviet power (see Table 36).

During the first period of development in the USSR, there was a sharp increase in the share of the railways (from 66 per

Table 36

The Freight Turnover of the Various Forms of Transport in the USSR (thousand million ton-kilometres a year)

Year	Total	Rail	Sea	River	Pipelines	Roads	Air
1913	115	76	20	29	0.3	0.1	—
1940	488	415	24	36	4	9	0.02
1950	713	602	40	46	5	20	0.14
1960	1,886	1,504	132	100	51	99	0.6
1970	3,829	2,495	656	174	282	221	1.9
1972	4,276	2,761	698	180	376	258	2.2
1973	4,624	2,958	751	189	439	284	2.4
1974	4,937	3,098	778	212	533	313	2.5
1975	5,200	3,237	736	222	666	338	2.6

cent in 1913 to 85 per cent in 1940), while that of sea and river transport fell. This was because most of the increase in freight traffic during the industrialisation years was in directions served by railways and also because of the low speed of river transportation. The increase in the freight-carrying capacity of the railways and their modernisation considerably raised the efficiency of rail transport and promoted its further growth. After the Second World War, sea transport began to develop rapidly in connection with the increase in foreign trade, and pipeline and road transport also began to develop. In 1975, the share of sea transport was 14 per cent, that of pipelines, 12.8 per cent

and that of road transport 6 per cent of the total. Correspondingly, the share of the railways dropped to 62 per cent. In order correctly to determine the share of the railways in internal freight turnover, foreign trade transfers and in-factory handling (within the plant or collective farm, etc.) should not be counted. In this case, the share of the railways rises to 77 per cent.

The trends in the changing shares of the various types of transport will also continue in the future. A further drop in the share of the railways is to be expected. Those of pipelines, road and then air transport will rise.

In terms of freight tonnage, it is road transport that holds first place in the USSR. In 1975, 21,000 million tons (including in-factory handling, etc.) were transported by road, but over very short distances. In the same year, 3,621 million tons were transported by rail, 200 million by sea, 475 million by rivers and 498 million by pipelines. A comparison of freight turnover (in ton-km) and the tonnage carried reveals considerable differences in the distances involved (see Table 37).

The average haul of freight per ton by road is not great, although it has increased by 50 per cent in comparison with

Table 37

The Average Haul per Ton for Types of Transport (in kilometres)

Year	Type of transport					
	Rail	Sea	River	Pipeline	Road	Air
1940	700	760	494	481	10	—
1960	798	1,732	474	390	13	800
1970	861	4,080	486	829	15	1,045
1972	871	3,927	456	966	15	1,043
1973	883	4,001	452	1,042	16	1,078
1975	894	3,650	467	1,337	16	1,036

1940. An average haul of freight per ton by rail has increased by 25 per cent since 1940, owing to the development of production in the eastern areas of the country.

The increase in the average haul of freight per ton by sea reflects the change in external economic relations and the increase in traffic between foreign ports. The general trend towards an increase in the length of rail, pipeline and road routes may be maintained into the future, considering the increase in the share of the eastern areas in the development of production and the growing trend for short-distance carriage (of up to 100 km) to be taken over from the railways by road transport.

The various forms of transport are of varying importance in the USSR. The railways are the basic, general form of transport. The role of the railways is a result of the enormous area of the Soviet Union and the need for large-scale freight transfers over long distances: in the European part of the USSR—between the North, the Centre and the South, between Donbas and the Volga area, and in the Asiatic part of the country—between the Urals, Siberia and the Far East; Siberia, Kazakhstan and Central Asia. There are no waterways connecting these areas and other forms of transport (pipeline, for instance) can only be used for some of the enormous turnover. Short-distance transportation of building materials, fuel and agricultural produce are handled by road, and so are long-distance transfers of perishables. The main freight of river transport is building materials, timber, logs, oil and oil products. Sea transport is the main vehicle of the USSR's foreign trade. Pipelines transport oil, oil products and gas. These functions of the different forms of transport in freight carriage will apparently be maintained in the future, too.

The distribution of passenger carriage between the different forms of transport has changed in the post-1945 years.

There has been a sharp drop in the share of the railways from 90 per cent or more before 1950 to 42 per cent in 1975. That of roads was 41 per cent in 1975 and that of air transport, 16.4 per cent. In terms of passengers carried in 1975, road transport holds first place with 36,500 million passengers (including urban bus services), with an average length of route of 8 km. Next come the railways with 3,470 million passengers, almost 90 per cent of whom were commuters. The average length of journey by rail was 90 km and 615 km for long-distance routes. The share of the railways

in inter-city carriage of passengers in 1973 was about 55 per cent. In order to calculate the scope of inter-city passenger transportation, the passenger turnover of urban bus services must be excluded.

The number of passengers travelling by air is rapidly increasing: in 1975 there were 98 million such passengers against 16 million in 1960. In the future, it is likely that air passenger transport will develop fastest of all and will take over a large share of long-distance travel. The railways will carry passengers primarily over medium distances and

Table 38

The Passenger Turnover of Various Types of Transport (thousand million passenger-kilometres)

Year	Total	Rail	Sea	River	Road (including urban)	Air
1913	33	30	1	1	—	—
1940	106	98	1	4	3	42
1950	98	88	1	3	5	1
1960	250	171	1	4	61	12
1970	553	265	2	5	202	78
1972	625	286	2	6	235	96
1973	657	257	2	6	254	99
1975	747	313	2	6	304	123

their share will probably drop even further. As the number of motor vehicles rises, the majority of short-distance journeys will be made by road and some long-distance ones too—tourists and others. In absolute passenger turnover, these three forms of transport are comparable but later, towards the end of the century, air transport will take the lead.

In order to evaluate the relative efficiency of the various forms of transport, the costs of transportation must be compared.

The cheapest form of transportation is by pipeline—it costs only 0.1 kopeck per ton-km to pump oil and oil products by pipeline. Then comes sea transport. It is interesting that, as a result of the high freight-carrying capacity of the railways, the cost of rail carriage is less than that of river

Table 39

The Cost of Freight and Passenger Carriage in 1975 (kopecks per ton-km and passenger-km)

	Rail	Sea	River	Road	Pipe-lines
Freight traffic. .	0.25	0.20	0.26	5.0	0.1
Passenger services	0.61	6.40	1.75	1.00	—

transport. Road transport is very expensive for freight carriage, and air transport is even more costly. For short distances, the cost of rail freight carriage rises sharply, since the expenditure on handling operations at the beginning and end of the route does not change with the distance covered. For short distances it adds a heavy burden to overall cost, which rises above the cost of road carriage.

For average distances of 894 km the cost of freight transportation by rail is about 2 rubles 20 kopecks. By road, the cost of carriage for the average distance of 16 km is 80 kopecks, and for 894 km, the average distance by rail, it would rise to 44.7 rubles.

For passenger carriage, the difference between the cost of rail and road transport (including urban bus services) is considerably less than for freight traffic. For river and particularly sea transport, the cost of passenger carriage is considerably higher than by rail: the fact that local routes, the share of which for water transport is fairly high, are made by small boat must be taken into account. By air, the cost of a passenger-kilometre in a large aeroplane filled to capacity, is not much higher than that in a sleeping carriage on an express train.

2. DEVELOPMENT OF THE TRANSPORTATION NETWORK

As the volume of goods carried by rail increases, transportation costs drop and this is what has been happening for several years. In 1973, the cost of rail carriage was less than a quarter of that in 1940. This is due to the increase in

labour productivity and in the technical equipment available on the railways, as their operations were gaining in intensity and organisation of transportation improved.

However, the capital investments required to build new routes are enormous. To build one kilometre of main line single-track railway costs 250-500,000 rubles or more, depending on the geography. The cost of building a kilometre of side line in a flat area is 200-250,000 rubles. In the future, the average cost of building railways will rise even more, since an increasing number of lines are to be built in the remote areas of Eastern Siberia and the Far East, in permafrost, marsh, and so on. Here, a kilometre of line costs two or three times more. With this construction cost and heavy traffic, the capital investment per ton-kilometre of reduced volume of traffic (the sum of ton-kilometres and passenger-kilometres) per year is from 10 to 15 kopecks on new lines, and fixed assets per ton-kilometre of reduced volume of traffic are from 1.3 to 1.5 kopecks.

Investment in the construction of motor roads, depending on their grade, number of lanes, type of surfacing and so on, is from 100-200,000 rubles to 1-1.5 million rubles per kilometre (for the biggest highways).

In the North, it costs up to 200-250,000 rubles to lay one kilometre of large-diameter pipeline. Small-diameter pipelines cost from 50,000 to 100,000 rubles per kilometre.

The construction of airports requires considerable outlays: a major airport may cost tens of millions of rubles to build. Large sea-ports are even more expensive to build—depending on the location of the port, on how convenient the natural harbour, bay or estuary might be, and on its size and the equipment to be installed in the intended port.

Considering the high cost of construction in all forms of transport, the most efficient measure is to increase their freight- and passenger-carrying capacity. The growth of freight turnover on the railways in the European part of the USSR is mainly facilitated by the strengthening and modernisation of the existing network, while in the Asiatic part of the country, it is to a substantial degree the result of new construction.

The total length of the railway network in the USSR increased in 1975 to 138,300 km against 72,000 km in 1913

(within the USSR's present boundaries) and 83,000 km in 1917. The world total is 1,235,000 km, meaning that the railway network in the Soviet Union constitutes 11 per cent of the world network, while the freight turnover is 50 per cent of the world total freight turnover.

The total road network (including all country roads) reached 1,430,000 kilometres in 1975, including 660,500 km of hard-surfaced roads, (or 5 per cent of the world total). In 1913, there were only 37,300 km of roads with hard surfaces (within the present boundaries of the USSR). In 1975, there were 296,700 km of roads with improved surfaces such as asphalt-concrete and black-top roads, the remaining 363,800 km are gravel and stone-paved roads. The building of hard-surfaced roads has progressed considerably in recent years: the length of hard-surfaced roads is now 144 per cent greater than in 1960 and that of concrete and asphalt-concrete roads is 285 per cent greater. However, in spite of this growth of the road network in the USSR, the construction rate must be speeded up. This is particularly important for improving the transport services in agricultural areas and for bringing the road network up to the standard required by the rapid expansion of road transport.

The total length of river shipping lines in the USSR is 146,000 km, or more than a quarter of the world total.

There are 827,000 km of air routes, including 645,000 km within the USSR, of which 285,000 km are of all-Union significance. Soviet air routes account for about 15 per cent of the air routes of the entire world.

The construction of major pipelines has expanded considerably in recent years and in 1975 there were 156,000 km of such pipelines, including 45,000 km of oil and oil-product lines (about 12 per cent of the world total) and 99,000 km of gas pipelines (14 per cent of the world total).

Now let us turn to the major problems of transport at the present time and the prospects for its further development. It must be said that, in spite of the substantial development of transport since the 1917 Revolution, it does not yet fully satisfy the growing demands of the economy.

A task of vital importance is to speed up the construction of railways throughout the country, and particularly in the eastern areas.

At present there is only a single latitudinal main line railway connecting the west with the east of the country as far as the Pacific coast. This is why the construction of the Baikal-Amur line, 3,200 km long, is of such major importance. This line will run north from Lake Baikal as far as Komsomolsk on the Amur, connected with Sovietskaya Gavan on the coast. The line will cross mountain ranges, and many rivers, and a large number of bridges will have to be built. This line is scheduled to open for traffic in the mid-1980s and this will bring life to the enormous area with vast natural resources, with prospects for development of the extractive industry, metallurgy and the timber industry. Towns and settlements will spring up along the length of the line.

Apart from the Baikal-Amur line, other rail routes must also be built in the eastern and northern areas of the USSR. A latitudinal line could be extended from Salekhard to Norilsk and longitudinal lines leading to the estuaries of the Ob and Yenisei (Salekhard and Dudinka) and, in the future, to the estuary of the Lena and, in the north-east, to Chukotka.

A series of railway lines must be built to improve transportation in the eastern and western parts of the country: from Northern Kazakhstan and the Southern Urals to Magnitogorsk and Volgograd, from the Northern Urals to Leningrad, and longitudinal lines from the Main Caucasian Range and further into the central regions and the Middle Volga, along the east bank of the Volga, and so on. The construction of a series of short-cut and auxiliary lines and branches will be of major importance for improving links between industrial centres and agricultural areas.

3. MODERNISATION OF TRANSPORT

The more rapid increase in traffic than in the length of railway lines has greatly raised the strain on the railways. In 1913, the freight-carrying capacity was more than a million ton-kilometres, i.e., about the same or somewhat more than in European countries. In 1975, the average volume of traffic per kilometre of operating railways reached 25.7 million ton-kilometres. This great traffic intensity is unique to

the Soviet Union. In theory, with powerful engines and automatic braking systems, the carrying capacity of electrified two-track lines can be considerably higher, but it is hardly feasible to work "in the red" in this way, considering the need to carry out improvements and repairs on the lines and other facilities, and also to retain a certain reserve for unscheduled traffic. All this means that the total length of railway lines must be increased significantly.

For several years, the development of the railways mainly took the form of modernisation. The rapidly increasing traffic was accommodated by an increase in the weight of trains, speeds and traffic intensity. This, in turn, was made possible by the transition to increasingly powerful engines, first steam engines and then electric and diesel, by the transition from two-axle to four-axle and also six- and eight-axle freight wagons, by the replacement of wooden passenger carriages to all-metal ones, the laying of heavier rails and crushed-stone beds, by the development of stations and the use of automatic signalling, centralisation and interlocking systems. All this has created a special type of rail transport enjoying the advantages of mass production. The economic advantages of this type of transport consist in the regularly increasing traffic at low cost and limited capital investment. If the traffic were accommodated through developing the network and increasing the rolling stock only, outlays would be immeasurably greater. At the present time, the need to combine further modernisation with new railway construction is becoming increasingly acute.

The length of electrified lines in the USSR reached 39,000 km in 1975, thus exceeding that of any country in the world and that of Britain, France, West Germany and Italy put together, and 13 times greater than in the USA. In 1975, diesel engines operated on 91,600 km of railway lines and steam engines on only 7,000 km. 51.7 per cent of freight is carried by electric trains, 48 per cent by diesel trains and only about 0.4 per cent by steam engines. The transfer of the railways on to electric and diesel power is still continuing.

The cost of electrification has increased in recent years and now stands at 80-100 thousand rubles per km. This investment goes mainly on the construction of permanent facilities

such as traction sub-stations receiving electricity from the general electric network, and contact networks. Each electric locomotive costs 150-175,000 rubles. For the transition to diesel traction, most of the outlays go on diesel locomotives which cost 250-300,000 rubles each (for main line locomotive), i.e., more than electric locomotives.

The transition to electric traction requires greater capital investment than diesel traction, but these outlays are offset by the considerably larger volume of freight than can be carried by diesel. The average speed of freight trains on electrified lines, despite the intensity of traffic, is 25 per cent higher than on diesel lines, and the average weight of a train is 12 per cent higher. The difference in the cost of carriage with both types of power is on the average not significant. If traffic intensity is not high, diesel transport comes cheaper. If the traffic is heavy, which is characteristic of the railways in the USSR, there is no doubt concerning the advantages of electric traction. The transition to new sources of power has made it possible for the railways to keep up with the rapid growth of freight turnover with a limited railway network.

At the same time, the modernisation of traction has yielded substantial savings. From 1956 to 1972, 1,300 million tons of coal were saved, which is equal to two years' mining output. Considering the present volume of transportation, 400,000 fewer workers are required than would have been needed to service steam locomotives. Running costs were cut by 24,000 million rubles over these years and 1,700 million rubles' worth of capital investment was saved.

In the future, too, even if the rate of railway construction rises significantly, the growing traffic will be accommodated mainly by means of improvements in the existing network, electrification of more lines and also the use of more powerful engines in order to increase the weight of trains. The average weight of a freight train at the present time is 2,800 gross tons. This figure can be raised considerably but this would necessitate expensive lengthening of sidings to accommodate the long trains. The weight of trains can also be raised by using specialised and high-capacity freight cars (up to 100 or more tons of load each) with six or eight axles, and also fitting the axles with roller bearings.

Heavy trains transport common freight such as coal, ore, building materials and the like. Apart from these, the railways also cater for a large number of small-batch loads, primarily industrial and consumer goods. The carriage of these small loads comes dear. It is expedient for these loads to be transported in containers packed by the dispatcher. The crane loading and unloading of containers helps to cut costs and increase the use of the carrying capacity of wagons. In recent years, the production and use of containers has increased substantially and nowadays about 40 million tons of freight are transported in this way every year.

A further growth of freight containerisation will reduce the cost and speed up the transportation of small-batch freight. An increase in freight carriage in packages and on trays is extremely efficient and also helps to reduce handling costs and make better use of wagon carrying capacity.

Increasing the weight of trains and their speed is an important way of accommodating growing traffic. This does not, however, suffice. The construction of two- and three-track lines produces a great effect. The traffic capacity at least doubles with the construction of a second track and if this is accompanied by the installation of automatic interlocking systems the traffic capacity increases severalfold (with a parallel traffic time-table and 10-minute intervals between train runs, up to 144 trains a day can pass each way). The cost of building a second track is nowadays up to 250-300,000 rubles per km and the cost of automatic interlocking system is up to 20,000 rubles. Centralised control (or pointers and lights throughout the sector served by the signal box) is extremely efficient.

The construction of second tracks will be essential in the future on a number of main lines carrying heavy freight and passenger traffic and, in the long run, third or fourth tracks may become necessary. On the Siberian route, where the traffic is particularly heavy, an additional one or two tracks may become necessary in the future on top of the existing two.

The growth of rail traffic has, for a number of years, taken place without necessitating an increase in the number of railway staff: in 1960, 2.3 million people were employed

on the railways and in 1975, 2.1 million, while there has been a significant increase in the amount of equipment used. Over these years, traffic almost doubled. This shows that labour productivity in railway transport has also doubled.

In the future, road transport must be developed further. In 1975, the output of motor vehicles was two million and this necessitates a substantial expansion of the road network. Particular attention must be paid to developing the road network in agricultural areas.

In 1970, the length of hard-surfaced roads increased by 28,000 km, including 16,000 km with improved surface. In 1975, the increase was 32,200 km, including 18,900 km with improved surface.

Modern highways will improve links between Union Republic capitals and major industrial centres. Many new roads will have to be built on the eastern bank of the Volga, in the Urals, in Kazakhstan and Central Asia, in Western and Eastern Siberia, and in the Far East.

With an expansion of the road network, work will increase on maintaining and repairing them, building motels, repair shops, petrol stations and the like. Industry must increase the output of spare parts for motor vehicles.

In the future, the output of large, small and special-purpose lorries will rise.

The future will also see a further substantial development of air transport. The steady and rapid growth of passenger traffic will put it in first place among the other forms of transport. Aircraft will also carry post and certain types of freight. The speed of turboprop planes reaches 800-850 km an hour (the Il-62, for instance), and of jet planes (Tu-154, for example) up to 1,000 km an hour. Supersonic planes such as the Tu-144 can develop a speed of up to 2,500 km an hour. Air routes are shorter than the corresponding railway lines by 15-18 per cent, than roads by 10-15 per cent and than river routes by 30-40 per cent.

With the transition to supersonic aircraft on long-distance routes, flight time will become even shorter. The capacity of aircraft will increase, in the near future, to 450-500 passengers and later an increase to 1,000 passengers is possible.

An important task facing the air service is to increase the safety of flights, and to this end, aircraft and airports are

being further improved and automatic navigation systems are coming into wider use. New airports are being built and existing ones are being modernised to provide all modern conveniences for passengers.

Work is going on to improve traffic links between cities and the nearest airports in order to cut down the time taken for passengers travelling both ways. This time, including that spent waiting until boarding, often exceeds the in-flight time and in the future, with the increased speeds, it may do so to an even greater extent.

Sea transport has developed considerably since the Second World War, primarily thanks to the building of a large merchant marine, now sixth in the world in terms of tonnage. The merchant vessels, most of which were built in the post-war years, are among the newest in the world, and a substantial proportion of them are fast and economical. There is still a shortage of special-purpose ships, however, such as tankers, container carriers that have developed substantially in recent years, lighter carriers and ships allowing horizontal loading. In future, the speed and capacity of new ships will rise. The construction of ports still lags somewhat behind the development of the merchant marine, and this results in wasteful delays during loading and unloading. This is why another important task is to speed up the modernisation of ports, extend them, deepen their approach channels and aquatoria for receiving large, deep-draught vessels, to lengthen wharves, mechanise loading and unloading and construct railway lines to and from the ship, thus making warehouses superfluous. New deep-water ports will be built.

During the years of Soviet power, a considerable amount of work has been done to construct a single network of inland waterways. Canals have been built—the Volga-Baltic, White Sea-Baltic, the Moscow and Volga-Don canals that are navigable for ships with a draught of 3.5 metres. Dams have been built on the Volga, Dnieper, Don, Yenisei, Irtysh and Angara to create reservoirs for large hydro-electric power stations. These dams have increased the depth of rivers, made them navigable for large vessels, made it possible to irrigate the surrounding agricultural areas and ensured water supply for industrial centres and large cities.

Large-scale hydro-engineering work is still to be carried out in the future to divert the waters of the northern rivers of the European part of the USSR —the Pechora, the Northern Dvina and the Vychegda—into the Volga and the Caspian Sea. This will make it possible to halt the fall in the water level of the Caspian as a result of vast quantities of water in the Volga basin being drawn off for irrigation. Part of the Volga water will be used to irrigate the agricultural areas between the Volga and the Urals and between the Volga and the Don, and also to replenish the fresh water of the Azov Sea. These measures are of enormous importance for the fishing industry. Plans have already been drawn up to divert the waters of the northern rivers into the Volga basin, but enormous capital investment is needed in order to implement them. The influence of these projects on the economy of the northern areas irrigated by the water of the Pechora, the Northern Dvina and the Vychegda and on the water regime of these rivers is still to be thoroughly studied. Another major problem is to use the waters of the Ob and the Irtysh to supply Central Asia and Kazakhstan and raise the level of the Aral Sea. Irrigation of agricultural areas in Central Asia may be of enormous significance for the development of cotton- and fruit-growing in regions that have climatic conditions ideally suited for these purposes but are short of water.

River transportation requires a considerable expansion of the river fleet. The fleet has been supplemented by large self-propelled ships which, to a certain extent, make it possible to overcome the drawback of river transport — slow speed. Recently the river fleet has also been supplemented by ships suited not only to large rivers and reservoirs, but also to the sea. River- and sea-going vessels with a capacity of up to 5,000 tons, with reinforced hulls, visit the ports of the Baltic and Black seas and link them with the river ports on the Volga and Dnieper and on the canals.

The freezing-over of rivers for 5-7 months of the year resulting in halts in navigation constitutes a serious shortcoming of river transport. Sea ports also become ice-bound. Some of these manage to operate throughout the year with the help of ice-breakers.

The recent decade has seen a rapid development of pipelines for the pumping of oil, oil products and gas. The advan-

tage of pipelines is that they operate continuously at a low cost. New pipelines are being built with large diameters and large carrying capacity. The diameters of the main oil pipelines are being increased.

At the present time, pipelines connect oil- and gas-fields with the central regions of the country, cross the Urals, Western and Eastern Siberia, and lead to the western frontiers of the USSR and abroad.

The development and improvement of new types of transport that are still at the drawing-board stage is a task for the future. Air-cushion means of transport (hovercraft) can be of major importance for travel in marshy areas, in snow and across bodies of water. Abroad, hovercraft have found application in passenger transportation over short distances (from Britain to France, for instance). This is a unique symbiosis of water and air transport. Another new means of water transport is the hydrofoil ship that has already earned itself a reputation and is bound to come into wide-spread use, as it allows a considerable increase in speed on rivers and on short sea routes.

One-track monorails, that cut the cost of construction, can be used efficiently for certain types of mass passenger transport. It would be of inestimable importance to speed up work on the electric car to replace motor vehicles, but for this purpose, reliable, cheap and light-weight storage batteries must be developed. The introduction of the electric car would mean a drop in the demand for petrol, put a stop to air pollution by the exhaust gases of internal-combustion engines and reduce noise.

Communications make greater and greater demands every year and the number of enterprises in this field is constantly rising. The number of post, telegraph and telephone enterprises in the USSR grew from 63,000 in 1960 to 88,000 in 1975, including a rise from 49,000 to 62,000 in rural areas. The product of communications for the same years rose from 1,300 to 4,800 million rubles, i.e., more than trebled.

In the next few years, the development of telephone communications, both urban and rural, as well as inter-city, must be speeded up. There have already been some successes in this field and an ever increasing number of cities can be switched on to an automatic dialling system. The production

of telephones and the construction of telephone exchanges will be stepped up and work on a unified automatic dialling system will be continued. The length of inter-city telephone lines will almost double and automatic and semi-automatic inter-city dialling systems will be expanded.

A further improvement in postal services is envisaged. In 1975, there were 19,800 letters, periodicals and parcels sent by post for every 100 inhabitants of the USSR per annum. Post in the USSR is largely carried by air, particularly over long distances. For 1960-1975, the volume of air delivery more than doubled. In 1975, 174 telegrams per year were sent per 100 inhabitants, and there were 178 million radio outlets, 60 million radio sets and 55 million TV sets in the country.

In years to come, a unified automatic system of communications is planned. This will be of major importance both for supplying the needs of the population and for managing and planning the national economy. The development of communications is also important in that it often allows savings to be made on transportation, when telephone, telegraph or radio can be used in place of personal contact. The creation of a system of computer centres interconnected by reliable communication lines will form the material base for the transition to an automated system of plan computation and will make it possible to use computers on a wide scale for these purposes. The network of radio and television broadcasting stations must be further developed to cover the entire country. Subscriber television (by line), video-telephones and other achievements of modern communications technology will also be developed.

CHAPTER XIII

CAPITAL INVESTMENT AND WAYS OF RAISING ITS EFFICIENCY

1. THE GROWTH AND STRUCTURE OF CAPITAL INVESTMENT

Economic growth in the USSR, the increase in production and rise in the welfare of the people are largely dependent on the successful course of capital construction, the introduction and operation of new capacities. For these purposes, annually increasing funds are allocated for investment in fixed assets, mainly productive, but also non-productive. More than half the capital investment in production projects is intended for construction and assembly work (construction proper), while the rest of the funds is invested in equipment, implements and tools. The bulk of capital investment intended for productive purposes goes to expand fixed assets and up to 30 per cent goes to renew worn-out fixed productive assets (primarily in industry and transport). The statistics on productive capital investment do not reflect expenditure on the formation of the circulating assets of new enterprises brought into operation or on increasing those of existing enterprises. In economic terms, these are lump-sum outlays, though they are different in nature from capital investment and have a different turnover period. Non-productive capital investment is mainly allocated for construction and assembly of housing, scientific, cultural, educational and health establishments, etc.

The total volume of capital investment from 1918 to 1975 was 1,487,000 million rubles at comparable prices. Capital investment from 1966 to 1975 reached 855,400 million rubles, or more than 57 per cent of the total. The average annual capital investment during the Ninth Five-Year-Plan period was 100,000 million rubles.

The growth of circulating productive assets during the Eighth and Ninth Five-Year-Plan periods by 126,600

million rubles testifies to the amount spent on increasing this capital. Adding circulating assets in the form of commodity and material stocks in the sphere of distribution, the increase was 174,000 million rubles.[1]

2. THE TASKS INVOLVED IN RAISING THE EFFICIENCY OF CAPITAL INVESTMENT

The volume of capital investment indicates the amount spent on building up fixed assets. This is an important indicator of the level of development of productive forces and the accumulation of social wealth. In order to assess fully the significance of these expenditures for the development of the national economy, it is not enough to know simply their volume—they must also be compared with the effect they produce. This effect may differ according to whether the capital investment was correctly or incorrectly distributed; whether the investment was used for projects of special importance for economic growth, technological progress, raising labour productivity, and for improving the population's welfare, and whether the funds were properly spent.

L. I. Brezhnev's report to the 25th CPSU Congress outlined the main tasks for capital construction: "The very approach to planning and utilising capital investments must be changed and the planning of operating industries and of new construction must be ensured as an integral whole. Investments must be allocated to ministries and departments not generally, not for new projects but for the planned increment in output. Material and financial resources must be channelled, first and foremost, for the technical re-equipment and reconstruction of operating enterprises...."[2]

In order to determine what effect capital investment produces or whether it is too costly, let us look at the efficiency

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[1] See *The National Economy of the USSR in 1975*, p. 731. Circulating assets in commodity and material stocks in industry, agriculture, transport, communications and construction. For collective farms in 1960 they were taken as 9,000 million rubles and in 1975, as 25,000 million rubles.

[2] *Report of the CPSU Central Committee and the Immediate Tasks of the Party in Home and Foreign Policy*, 25th Congress of the CPSU, Moscow, 1976, p. 55.

of capital investment. For this purpose we shall turn to the indicators of absolute (overall) efficiency as envisaged by the Model Method for Determining the Efficiency of Capital Investment (meaning the return on capital investment and assets) and also indicators of comparative efficiency—a drop in reduced costs, saving on the production costs profitability.

Absolute efficiency indicators reflect its true significance for the national economy as a whole. Deviations of price from value for individual types of output cancel on the national level where the sum of prices is equal to the sum of values. The influence on the efficiency of investment of price changes over time can be eliminated as the calculations are made in comparable prices. Changes in the structure of investment by branch of the economy and by area may have a bearing on the result of the calculations of investment efficiency, as this efficiency is far from even. Account must be taken of this when analysing the results of capital investment. Furthermore, it must be remembered that not all changes in the national income are connected with capital investment. The size of the national income is also affected by organisational factors—the efficiency of management, and production and labour organisation. It has been calculated that organisational measures (such as the transition to a new system of management or a strengthening of material stimuli and changes in the system of payments) may account for 10-20 per cent of the effect produced by capital investment. But changes in organisational factors that might influence the effect produced do not take place frequently.

Capital investment does not have an immediate effect on the increase in the national income. Many projects take more than a year to build and usually more than a year to acquire full capacity. This is why it is important to take account of the lag between investment and the effect produced. Correlated calculations made by various scientific organisations (the Institute of Economics of the Lithuanian SSR, the Economics Department of the Bashkirian Branch of the USSR Academy of Sciences) suggest that this lag is in the order of 2-3 years. For this reason, along with capital investment, strict account must also be kept of the introduction of fixed assets into operation, i.e., capital investment in

completed construction projects. In this case, the question still remains of the lag connected with the running-in period. Bearing in mind that a considerable proportion of capital investment is made in projects that require only short construction time, the lag can be taken, in our opinion, as equal to one year in general calculations. Besides, one should remember that about 20 per cent of all gross investments are aimed not to increase active funds, but to replace worn-out ones.

The amount of fixed assets accepted each year is somewhat lower than capital investment owing to the size of the lag, as the former for a given year is determined by capital investment in the previous year (or previous years). Over time, the annual growth of both indicators is more or less stable. As for increments in the national income, these indicators fluctuate considerably from year to year. The minima fall on years of bad harvest—1963, 1972, 1975, and the maxima in 1970 and 1973. In order to compare the data presented in Table 40, we shall take the average magnitudes. The mean annual capital investment over the 15 years was 73,500 million rubles and the amount of assets introduced into production was 68,000 million rubles, while the increment of the national income was 14,500 million rubles. Thus, capital investment and the introduction of fixed assets are covered by the increase in the national income over 5.1 and 4.7 years.

It should be borne in mind that return on assets does not give a full impression of efficiency, since the result of capital investment as it figures in the statistics is not only a growth in output, but also a drop in production costs or the replacement of worn-out means of labour. Expenditure per ruble of marketable output in industry in the comparable prices dropped by 0.81 kopeck a year between 1966 and 1975 and the average gross product of industry for these ten years was 383,000 million rubles per annum. Thus expenditures on the overall mean annual product of industry dropped by about 3,100 million rubles per annum. Investment in industry from 1965 to 1974 (bearing in mind the three-year lag) constituted 28,330 million rubles per annum on average. Subtracting 20 per cent to replace worn-out funds, we obtain 22,600 million rubles. This

means that the average length of the recoupment period through a drop in the production costs of industrial output was 7.3 years, or about 14 per cent. This is an additional efficiency indicator to the change in the return on assets in industry. Over the period of 1966-1972, the return on assets fell somewhat from 70 kopecks in 1966 to 66 kopecks in 1972. These figures represent the ratio of that part of the national income produced in industry (its net product) to the amount of fixed assets in industry (as of Jan. 1, 1966 and Jan. 1, 1972), i.e., before the revaluation of assets, which means that the two indicators are comparable.

Table 40

The Dynamics of Capital Investment, Introduction of Fixed Assets and Increase in the National Income (thousand million rubles)

Year	Capital Investment	Introduction of fixed assets	Increase in the national income
1961	43.8	38.7	7.9
1962	45.9	43.4	11.7
1963	48.3	47.3	4.2
1964	52.6	50.3	12.5
1965	57.0	52.2	12.2
1966	61.0	55.9	13.9
1967	66.0	60.5	18.1
1968	71.2	62.6	18.6
1969	73.6	67.7	17.8
1970	82.0	77.7	28.0
1971	88.0	82.6	15.1
1972	93.8	85.4	8.6
1973	97.6	94.4	24.2
1974	105.7	98.9	16.2
1975	114.9	107.4	8.8
Average per year	73.5	68.0	14.5

The recoupment periods affected by the drop in production costs calculated in a similar way are much longer for other sectors of the economy than for industry. In construction, production costs dropped by only 3.2 per cent from 1965

to 1972, and in railway, sea and river transport, they actually increased somewhat. There are various reasons for this: a rise in the wages of building workers and the cost of materials, fuel, and the like.

For branches and sub-branches of industry and also for individual enterprises, the fluctuations of return on assets can be judged from the ratio of gross product to assets $\frac{P_g}{A}$ or to capital investment $\frac{P_g}{I}$. The ratio of assets to the gross product $\frac{A}{P_g}$ for industry as a whole was 61 kopecks in 1966, but 59 kopecks in 1972. If capital investment is used instead of assets, account must be taken of the fact that this represents the increase indicator and should in fact be related not to the product, but to its increase, assuming that capital investment is made for the sake of this increase. Statistics do not, however, distinguish between capital investment that goes on increasing the product, on improving production without such an increase and on replacing worn-out equipment. So, even if there is no increase in the output, there is some capital investment but, of course, far less than that required to expand production. Investment in modernisation without increasing the volume of output is possible, but in the majority of cases it is also intended to increase production.

The lag must also be taken into account when capital investment is compared with the increase in output. For the sake of simplicity, we shall take the lag as equal to one year, i.e., we shall relate capital investment in one year to the output increment the following year.

Such comparisons are made in tables 41 and 42. Table 41 gives the ratios of capital investment to the increase in the product in physical units, while Table 42 gives the dynamics of these indicators (calculated specific capital investment by physical and value indicators for each year are taken as a percentage of the previous year).

The tables show that from 1966 to 1973, in industry as a whole there was an overall rise in specific capital investment in the increase in the product. There are significant fluctuations between the different branches of the economy,

Table 41

Ratio of Specific Capital Investment to the Increase in the Product of the Following Year*

Capital investment / Increase in output	1965 / 1966	1966 / 1967	1967 / 1968	1968 / 1969	1969 / 1970	1970 / 1971	1971 / 1972	1972 / 1973	1973 / 1974	1974 / 1975
All industry (rubles to thousand rubles of output)	1,096.5	568.7	618.1	1,110.2	873.9	1,336.3	1,245.9	1,186.8	921.9	1,019.4
Electricity generation (rubles to thousand kwh)	66.6	61.31	53.8	54.5	54.1	52.61	59.7	59.7	56.2	60.0
Coal (rubles to tons)	180.5	153.9	—	107.9	88.0	91.7	113.6	138.1	106.2	129.9
Oil (rubles to tons)	93.2	93.8	101.21	114.3	91.4	104.9	118.4	105.0	102.7	103.4
Gas (rubles to thousand m^3)	40.2	52.0	73.4	76.5	55.4	71.8	124.7	82.4	60.0	61.0
Ferrous metallurgy (rubles to tons of steel)	311.0	328.7	463.5	595.8	384.1	433.7	448.4	401.2	628.7	553.7
Building materials (rubles to 100 rubles of output) .	134.2	70.5	76.8	153.3	135.2	196.8	124.4	283.0	152.8	134.9

* The figures in each column represent the ratio of capital investment for the previous year (in rubles) to the product for the given year in physical terms. Capital investment for industry as a whole, however, is per thousand rubles of gross product and for building materials per 100 rubles of gross product.

Table 42

Ratio of Capital Investment to the Increase in the Output of the Following Year as a Percentage of Capital Investment in 1965

Capital investment Increase in the output	1965 1966	1966 1967	1967 1968	1968 1969	1969 1970	1970 1971	1971 1972	1972 1973	1973 1974	1974 1975
All industry	100	51.9	56.4	101.3	79.7	121.9	113.6	108.2	84.1	93.0
Electricity	100	91.7	80.8	81.8	81.2	78.2	89.6	89.6	84.4	91.0
Coal	100	85.3	—	59.8	48.8	50.8	62.9	76.5	58.8	72.0
Oil	100	100.6	108.5	122.6	98.7	112.5	127.0	112.7	110.1	110.9
Gas	100	129.4	182.6	190.2	137.8	178.6	310.1	204.9	149.3	151.7
Steel industry	100	105.7	149.0	191.6	123.5	139.5	144.2	129.0	202.1	178.0
Chemical and petro-chemical industry	100	83.5	81.7	80.7	74.7	65.7	82.6	68.9	71.9	72.0
Engineering	100	93.6	99.0	104.1	110.5	115.1	110.7	101.0	94.9	100.9
Timber, timber-processing, pulp-and-paper industry	100	65.2	91.3	112.2	61.8	79.3	116.5	95.3	155.4	77.6
Building materials	100	52.5	57.2	114.2	100.7	146.6	92.7	210.9	113.9	100.5
Light industry	100	88.2	111.1	167.1	119.3	145.6	385.9	246.8	250.3	201.7
Food industry	100	67.5	96.1	122.2	68.9	97.1	171.8	103.7	70.4	106.5

Note: For all industries, 100 is taken as the ratio of capital investment in 1965 to the product in 1966. In all columns, the ratio is taken of capital investment in the previous year to output in the given year and the result is taken as a percentage of the base year figure. For the timber and other industries in this group, the increase in output over 1965-1966 is taken as 100 per cent. In the chemical and petro-chemical industries, engineering, the timber, timber-processing, pulp-and-paper, light and food industries, specific capital investment is defined as capital investment of the previous year divided by the gross product in rubles.

however. In electricity generation and coal mining, the chemical and petro-chemical, timber, timber-processing and pulp-and-paper industries, specific investment fell overall during the 1960s, but there has been a noticeable increase since 1970. There has been an increase in engineering, oil extraction and the food industry. For the gas and light industries, and building materials (cement) there has been a clearly noticeable increase in specific investment.

The rather substantial fluctuations of the indicators in both tables are due mainly to changes in the rate of output growth and, to a lesser degree, to changes in the actual specific capital investment itself.

Another indicator of the efficiency of capital investment by branch and individual enterprise is profitability—the

Table 43

Profitability for the National Economy and Industry

	1965	1970	1971	1973	1975
Profits for the whole national economy (excluding collective farms) (thousand million rubles)	37.0	87.0	90.1	98.0	105.0
Fixed assets on January 1 (thousand million rubles)	52.8	737.0	799.0	1,003.0*	1,165.0**
Ratio of profits to assets (profitability)	6.9	11.8	11.3	9.8	9.0
Profits of industry (thousand million rubles)	22.5	56.0	56.2	60.0	65.9
Fixed assets in industry on January 1 (thousand million rubles)	187.0	227.0	248.0	300.0*	353.0
Ratio of profits to capital (per cent)	16.0	24.6	22.6	20.0	18.7

* Fixed assets after revaluation. Assets at old prices constituted 862,000 and 268,000 million rubles, respectively, and the ratio of profits to capital was 11.4 and 24.2 per cent. Circulating assets were not taken into account.

** Fixed assets on January 1, 1976 were 1,258,000 million rubles for the national economy and 385,000 million for industry.

ratio of profits to assets or that of the increment in profits to capital investment. This indicator, in our opinion, does not give a sufficiently accurate reflection of efficiency.

Profits in the national economy as a whole and in industry have generally grown overall far more rapidly than fixed assets, and profitability has increased, while the output-assets ratio has fallen. The growth of profitability is connected to a considerable degree with price increases and cannot serve as an exact indicator of the growth of efficiency.

The comparisons presented above indicate that capital investment and fixed assets are still not used efficiently enough. While the plan for capital investment is fulfilled in a number of industries, they are behind in the commissioning of new plant.

The country is in need of a considerable amount of new equipment and the engineering industry cannot keep up with the demand. At the same time, as a result of construction delays, much equipment is not utilised and there are empty production buildings (particularly in the chemical industry and ferrous metallurgy). Construction periods are still too long. Large projects take from 8 to 12 years and considerably exceed the norms, which are themselves excessive. In many cases, actual construction periods are double the norm. One of the main tasks for all construction organisations, clients and suppliers is to achieve a substantial reduction in the length of construction periods. Experience has shown that when construction is well organised, plant is delivered on time, and the work of contract and design organisations is co-ordinated, the time required to put the project into operation is cut down. Projects of this type include, for instance, the Ladyzhenskaya Power Station in the Ukraine which was built in 44 months while the norm was 59, the Svetlopolskaya mine in the Ukraine, built in 59 months while the norm was 60, the Uvarovsk chemical factory in the Tambov Region, the first section of which was built in 30 instead of 31 months and the second in 16 instead of 23, the Chernorechensk, Novgorod, Cherkassk amalgamations of chemical plants, and so on.

In a number of instances, the long construction periods are supplemented by a long running-in period, not infrequently of three to five years, as a result of unfinished con-

struction work, defects in equipment, errors in design, lack of training of the labour force and other factors. The existing standards for running-in periods, though high, are not always fulfilled. The slowness of this process results in production plans not being fulfilled and output falling thousands of millions of rubles short of the amount required. If construction is organised properly and the enterprise prepared in advance it can usually work at full capacity almost from the beginning.

There is no shortage of examples of productive plant being brought into full operation within a short time, much faster than the norm (the Western Siberian metallurgical plant, the Novo-Kemerovo Chemical Combine, the car plant in Togliatti, the Belovo power station and others). Accurate and co-ordinated work must be required of all the participants in the construction process—builders, suppliers of raw and other materials and equipment, acceptance officials, sub-contractors and those who organise the preparation of the enterprise for being put into operation. This will inevitably lead to positive results.

Considering that an additional two to three years for designing has to be added to the long construction period of seven to ten years and the running-in period of three to four years, it turns out that by the time the enterprise begins working at full capacity, it is already technically obsolete and the large expenditures do not produce the required effect.

A major means to eliminate shortcomings in capital construction is to make capital investment more concentrated. More than 260,000 production projects are under construction in the country. In 1972, the construction and modernisation of 53,000 new and existing large-scale enterprises was financed by centralised capital investment, and 20,000 by decentralised capital investment. The cost of the projects under construction was several times higher than the capacity of construction organisations, and also of the engineering and other enterprises supplying these projects with equipment and materials. Suffice it to say that, for example, for the 15,000 enterprises and installations being built on new sites in 1972, at an overall estimated cost of 137,000 million rubles, only 16,700 million rubles of capital investment

could be allocated to them in all[1]. This pulverisation of investment is the result of a considerably larger number of new construction projects being included in the plans at the insistence of ministries and authorities, republics and regions, than the national economy is capable of accomplishing. The inclusion of more and more new projects in the plan is usually motivated by good intentions—to expand production, utilise natural resources more fully, employ construction personnel in a given area, ensure the development of related branches, etc.

On the other hand, the efforts of planning organisations to elaborate a taut construction plan in order to make full use of available investment resources are also understandable. This will not, however, achieve its goal if the planned volume of work does not correspond to the capacity of the construction organisations and available equipment and raw materials. So an extremely important condition for improving the planning of capital construction is to coordinate the planned volume of work with the possibilities of the construction organisations and material and manpower resources.

When capital construction is financed on a grant basis by the state, however, and the organisations pressing for their requests to be included in the plan are not materially or in any other way responsible for the efficiency of the projects built, these requests are often exaggerated.

The Scientific Council on Efficiency of Capital Investment of the USSR Academy of Sciences long ago realised the need for a statistical study of the actual efficiency of investments and the methodological principles for such a study have been worked out. Recently, the USSR Central Statistical Board has attempted to develop a method for statistical calculation of the actual efficiency of investment, as a result of which the possibility of solving this major problem has arisen. Determining actual efficiency makes it possible to compare the real cost of projects with the estimated one, and the planned recoupment period with the actual period, to reveal the causes for any divergence and, in the final analysis, to

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[1] See *Voprosy ekonomiki* (Problems of Economics), 1973, No 8, pp. 31-32.

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take measures to eliminate such divergences. Statistics on actual efficiency must, of course, be kept on a regular basis, as only then will it be possible to count on both contractors and clients knowing that they are under supervision and control and, therefore, aiming to carry out work in the shortest possible time and not waste state funds, material resources and living labour.

In order to eliminate the shortcomings in construction, in 1969 the CPSU Central Committee and the USSR Council of Ministers adopted resolutions on improving capital construction, its planning, financing and designing. These resolutions envisaged a wide range of measures to eliminate shortcomings and improve capital construction.

An important measure aimed at regularising the planning of capital construction is a more strict and accurate selection of projects to be included in the plan. To this end, the growth of the overall volume of capital investment was limited, and so was decentralised investment which in 1972 stood at about 20 per cent of state investment. The number of new construction projects undertaken was also cut down.

To regularise capital construction stable plans are necessary. Construction takes time and major projects are built over several years, so construction must be based on a five-year plan, broken down for individual years. The annual plans might include adjustments only as rare exceptions, while at the moment these are extremely numerous and sometimes change the plan fundamentally, causing dispersion of capital investment.

Of major significance for regularising the financing of capital construction is the replacement of payment by the client to the contractor for the volume of work done, by payment for fully completed and accepted projects. About 90 per cent of construction work at the present time is contract work. Up to 1969, all clients paid the contractor monthly for the volume of work actually done (foundation pit, foundations, walls, and so on). This meant that the contractor was interested primarily in fulfilling the most profitable jobs, so without completing one project he would start on another, dragging out the less profitable finishing jobs. The need was recognised for transition to payment for fully completed and accepted projects, which meant that

the construction agencies had to receive from the state circulating assets. At the same time, it was intended that they should transfer on to a fully non-subsidised basis on the same conditions as industrial enterprises, with the establishment of three incentive funds from profits and material incentives for fulfilment and overfulfilment of the plan. In 1975, about 2,710 construction organisations fulfilling 71 per cent of the total volume of work were operating on a non-subsidised basis.[1]

In order to improve design and estimation, the 1969 resolution envisaged measures to improve the work of design organisations, ensure the timely elaboration and adoption of project designs and rationalise estimate compilation.

Many of the shortcomings in designing have not yet been overcome, however. In May 1974, a country-wide conference on design estimates was held to discuss ways of improving designing. The main tasks are to make use of more advanced techniques in designs, cut the time taken in drawing up plans (which sometimes take two to three years or more for major projects) and reduce the volume of paper-work. In this connection, the question arises of transition to one-stage designing, which would cut the volume of designing work and construction periods, too. It is also essential that better use be made of standard designs which, however, have a narrower application in industrial than in housing construction.

A very important task for designers is economic justification and selection of the optimal variant for intended construction projects. The methods for determining the economic efficiency of capital investment developed by Soviet specialists and elaborated in the two editions of the Model Methods for Determining the Efficiency of Capital Investment (1960 and 1969) are now already generally adopted and form the basis of numerous branch instructions.

3. METHODS FOR DETERMINING THE EFFICIENCY OF CAPITAL INVESTMENT

The efficiency of planning and design measures can be judged by comparing actual expenditures with the effect produced. Not everything can be expressed in value terms

[1] See *The USSR in Figures in 1975*, pp. 166-167.

but in the majority of cases, value indicators give sufficient foundation for determining absolute and relative efficiency. A comparison of value indicators might be supplemented by analysis of indicators in physical terms.

Absolute (or overall) economic efficiency is defined as the ratio of the increment in the net product (the national income) to capital investment $E = \frac{\Delta N}{I}$ or of the entire net product to capital $E = \frac{N}{A}$. It is advisable for account to be taken of the lag of one to two years between investment and effect. For separate industries and enterprises for which the net product is not computed, profitability can be used as an indicator of efficiency, i.e., the ratio of the increment in profits to capital investment $\frac{\Delta P}{I}$ or of total profits to assets $\frac{P}{A}$.

The quantitative results received from calculations in these instances are, of course, different, i.e., the values of $\frac{\Delta N}{I}$, $\frac{N}{A}$, $\frac{\Delta P}{I}$, $\frac{P}{A}$ are not equal. If it is a matter of a single project, then the changes in these indicators can be compared, if of different projects, then the comparison must be made for one and the same indicator.

The absolute efficiency indicator was proposed in 1957 and was later included in the Model Methods for Determining Efficiency. The inclusion of an absolute efficiency indicator in the plan will be of major importance. Absolute efficiency is the target of the enterprise, the association, the industry, the republic and, finally, the national economy. The level of efficiency achieved will, of course, differ according to the assessment of the actual capacity of the given project. The presence of such a target and the need to achieve it will act as a stimulus to make better use of available resources and organise production better. When a design is being developed, the absolute efficiency indicator will allow judgements to be made both on the importance of the planned project and on the quality of the design. The calculation of absolute efficiency according to report data will show how successful the economic activities of the project are and the extent to which the planned targets are fulfilled or the project completed.

Sometimes the question arises whether it would be possible to use the absolute efficiency indicator in the selection of versions and whether the two indicators—of absolute and relative efficiency—are both necessary. These questions have a certain justification. Versions can also be compared according to the absolute efficiency indicator if the calculation is carried out correctly, but this will be too complicated. There may be many possible versions and far from every indicator changes for each of them, but only some, meaning that a complete recalculation is required in each case. This is not the main thing, however. Initially, relative efficiency of versions was conceived as a definition of the recoupment period of the so-called additional capital investment (differences for the versions) $I_1 - I_2$ through savings in current costs $C_2 - C_1$. The ratio $\frac{I_1 - I_2}{C_2 - C_1}$ is the recoupment period t, which can be compared to the standard t_0. Experience has shown that such calculations are too cumbersome, particularly when there is a large number of versions. The formula $\frac{I_1 - I_2}{C_2 - C_1} = t_n$ is transformed into the formula for reduced expenditure $I_1E + C_1 = I_2E + C_2$, where $E_n = \frac{1}{t_n}$. The value of reduced expenditure received is thus, for every version, the sum of production costs and deductions from capital investment proportional to the established standard E_n.

Reduced expenditure is a comparatively new indicator in economic usage. It is not the price of production, as some people believe, since E_n is not average profit, but the lower, marginal value of efficiency, the inverse of the standard recoupment period. The opinion that is sometimes voiced that the level of the coefficient of relative efficiency is directly proportional to the level of absolute efficiency is, therefore, incorrect. In fact, the magnitude E_n depends on the capital investment volume. Assuming an unlimited volume, the amount of investment can be as great as desired, E_n will tend to zero, and the efficiency of the version can be judged only from the drop in production costs. Assuming the minimum of this volume, i.e., the absence of resources for capital investment, the efficiency

coefficient will become infinitely large and those versions requiring minimal or no investment will be the most efficient.

So the coefficients of absolute and relative efficiency must change rather in opposite directions: a high absolute efficiency leads to large accumulations, which means that the relative efficiency coefficient may be lower rather than higher.

Reduced expenditure can be computed assuming one-off capital investment and unchanging current expenditure over time. As a rule, this is a particular case in the comparison of versions. In many instances, for example, in the comparison of different versions for the construction of enterprises or for the development of an industry, capital investment is made continuously and, consequently, current expenditure also changes over time.

If the comparison is made for a relatively long period, 15 years for example, total capital investment and current expenditure for the entire period can be simply summed for the different versions and the lowest sum will be the optimal one. Such a method, however, does not take account of the inequality of expenditures made at different times. The moment when these expenditures are made and how far they might be from the present time is far from insignificant. If for one version, a large proportion of the expenditure is made at a more distant time than for another version, this means that if the first is adopted, certain saving can be made in expenditures in the first few years. This is tantamount to increasing the capital investment volume for these years. The resources thus saved can be invested in a project that could otherwise not be initiated, and ensure an effect roughly equal to the norm. This provides justification for discounting the amount saved at compound interest rates according to the expression $(1 + E)^t$. Usually capital investment and current expenditure are reduced to the initial years on the basis of the inverse coefficient of growth, i.e., $\frac{1}{(1+E)^t}$. The distribution of expenditures over time thus acquires major significance and if the summed expenditures for the different versions are equal, then the version for which the larger part of expenditures are made in the more distant periods is

preferable,[1] when the level of the productive forces of the country will be much higher, the absolute size of accumulations and possibilities for allocating resources for the given capital investment will be greater.

Turning to a consideration of factors resulting in an inadequate efficiency of capital investment, let us note that these can be arbitrarily divided into subjective and objective ones. Subjective factors include shortcomings in management, planning and organisation of capital construction discussed above, namely: dispersion of capital investment, drawing-out of completion time, exceeding of estimates, shortcomings in planning and design, insufficient economic justification of projects, low material interest of construction organisations, and so on.

Another group of factors are conditionally objective. This group in turn can be divided into two sub-groups. One sub-group is connected with the national economy as a whole and depends little on construction itself: this includes changes in the sectoral structure of capital investment, technological progress, the balance between new construction and modernisation, the use of natural resources of different qualities and the location of production. The second sub-group of objective factors is in the sphere of construction: mechanisation, industrialisation, the use of new materials, the training of the labour force. In the final analysis, objective factors are, of course, created by people, but all the same, their influence on the efficiency of capital investment is not direct and does not tell immediately.

Changes in the sectoral structure of capital investment affect total efficiency.

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[1] The following example illustrates this. Let us assume that the sums of expenditures for both versions in a five-year period are the same—350,000 rubles, but that they are differently distributed over time: for the first version (in thousands of rubles) $50 + 60 + 70 + 80 + 90 = 350$, and for the second version $90 + 80 + 70 + 60 + 50 = 350$. The reduction coefficient is $\frac{1}{(1+E)^t}$. If $E = 0.1$, the reduction coefficient in the 1st year is 1; 2nd year —0.91; 3rd year—0.83; 4th year —0.75; 5th year —0.69. For the first version we get the series $50 + 54.5 + 57.9 + 60.1 + 61.7 = 284.2$, and for the second $90 + 72.7 + 57.9 + 45.1 + 37.7 = 303.4$. So the first version gives a lower sum of reduced expenditure.

Agriculture and transport have a lower return on assets than industry. An increase in the share of capital investment in these sectors, and particularly in projects such as irrigation and drainage, production and storage premises, housing construction and the building of new railways and roads, might lead, at least at first, to a drop in the output-assets ratio and a growth of production costs. This investment is essential, however, for the further development of the economy and in subsequent years, as new construction projects come into operation, the return on assets rises and production costs fall.

The same goes for investment in the non-productive sphere. This investment does not directly give rise to an increase in output, and the return on assets for the economy as a whole falls as a result. Subsequently, however, the improvement in living conditions, domestic services, medical care and education brought about by the investment will help to raise the standard of living of the population and thus facilitate a growth in the productivity of social labour, and at the same time a growth in the social product and the return on assets.

4. FACTORS GOVERNING THE INCREASE IN THE EFFICIENCY OF CAPITAL INVESTMENT

A tremendous influence is exerted on the efficiency of capital investment in all branches of production by technological progress. The introduction of new technology requires capital investment. This is the main condition for the introduction of scientific discoveries and achievements in the technical sphere into production. The efficiency of new technology is clearly, as a rule, also the efficiency of the capital investment required for its introduction. This capital investment is profitable when it is justified by an increase in labour productivity, an increase in the volume of output and a drop in production costs.

It is, therefore, essential that those types of new technology be selected, the use of which will ensure a rise in efficiency of not less than the established rate. Here again, a study of efficiency over a fairly long period is of major importance. In many cases, capital investment in new tech-

nology does not immediately give an effect equal to the norm. But as the new technology is mastered, the effect rises, reaches and exceeds the norm. So, only by taking account of all these facts can a substantiated assessment of the efficiency of the new technology be given.

In order to raise the efficiency of capital investment throughout the economy, it is of major importance to establish a correct balance between investment in new construction and in modernisation and expansion of existing enterprises. The solution to this problem necessitates the calculation of relative efficiency. In many instances, it is more efficient to provide for the necessary growth in output by means of modernisation and expansion of existing enterprises than through new construction.

The share of capital investment in modernisation and expansion of existing industrial enterprises in 1973 was 65 per cent.

Leaving out the coal industry, where expansion has certain specific features and takes place mainly through the working of used seams, the large shares of modernisation and expansion is observed in iron-and-steel, engineering and some other industries (70 per cent), and the lowest in the power industry (30 per cent), where a considerable proportion of existing plant has been installed during last years.

The advantages of modernisation over new construction stand out when it permits the planned effect to be achieved at a minimum expenditure within a short time. So modernisation is profitable if it serves as the basis for a renewal of equipment and production methods on a higher technical level, for specialisation of production and the elimination of bottle-necks without requiring enormous expenditure on construction, replanning of premises, and so on. A fundamental modernisation of old enterprises is usually inexpedient, particularly under the conditions prevailing in large cities. The development of new types of production is, as a rule, better accomplished on the basis of new construction. These requirements are not always met and it happens that capital investment in modernisation exceeds the fixed assets of the existing enterprise, and the work drags out for years. In a number of instances, even before modernisation for the output of new models, such as more powerful lorries, has been completed,

the enterprise begins modernisation to produce even more powerful models, so that it is constantly in the process of modernisation.

The accelerated replacement of obsolete equipment with new at existing enterprises can lead to a fall in the output-assets ratio. On the other hand, however, worn-out and obsolete equipment keeps the productivity of labour at a far lower level. So, in order to determine the efficiency of replacement on different scales and at different times, taking into account expenditure on extending plant capacities to produce the required equipment, detailed calculations are needed allowing a comparison to be made between direct and indirect expenditure with the possible economic effect.

An increase in the share of modernisation promotes changes in the technological structure of capital investment through a rise in the share of expenditure on equipment. This is one of the main economic indicators. The greatest effect is produced by an increase in the share of equipment—the "active" part of productive assets. This becomes possible if there is a rise in the share of capital investment in improving machinery, tools and implements, and a fall in that of investment in buildings and installations as a consequence of improved construction and a drop in the prices of construction and assembly work.

The share of capital investment in the "active" part of fixed assets was 30-31 per cent during the Eighth and Ninth Five-Year-Plan periods against 10 per cent during the First and 12 per cent during the Second Five-Year-Plan periods. Account must be taken of the fact that data relate to the total mass of capital investment, including non-productive investment. For productive capital investment, the share of the "active" part is substantially higher (40-42 per cent at present and 12 per cent during the First Five-Year-Plan period). The increase in the share of the "active" part is partially explained by a rise in the prices for the output of the engineering industry.

In the USA and West European countries, the share of the "active" part of capital investment is higher than in the USSR, but here it must be remembered that the Soviet Union has a more severe climate. As a result, particularly in the northern regions and Siberia, the light-weight constructions

used fairly widely in the USA and Western countries are not feasible in production premises, and equipment can only be left in the open air in very rare circumstances (for example, part of the equipment of electric power stations and sometimes the turbines, too). Even so, the share of the "active" part of capital investment could be raised further and, in any case, this possibility must be taken into account in planning and design.

A considerable influence is exerted on the efficiency of production by better and fuller use of natural resources. With the present rapid rate of growth of production, this often reduces efficiency, for as better resources are depleted, other or less rich or more distant ones have to be used, and this reduces efficiency and the output-assets ratio. Nature conservation also requires outlays.

The transition to poorer or more distant resources, however, is counteracted by the discovery of new ones as a result of the surveying and prospecting or achievements in science and technology opening up new possibilities for making use of nature.

A change in the location of productive forces also has a bearing on the efficiency indicators of capital investment. Shifts in location represent one of the major prerequisites for rapid development of production in the USSR, but they necessitate large capital investment for a number of reasons: large expenditures on transportation, more severe climatic conditions (low temperatures and permafrost), and higher wages as mentioned earlier. On the other hand, the large scale of enterprises and their high productive capacity also tell on the amount of specific investment. Construction in newly explored areas where various basic and auxiliary enterprises can be combined and built according to a rational town plan, has considerable advantages.

A major role in raising the efficiency of capital investment belongs to production complexes. During the Ninth Five-Year-Plan period, such complexes were initiated on the basis of the iron-ore resources of the Kursk Magnetic Anomaly, the oil- and gas-fields of Western Siberia, the electric power of the Sayany and Bratsk hydro-electric stations and so on. Such complexes might be national in scale, like the first two, or territorial-production, like the Sayany and Bratsk

complexes, or industrial units, like the Krasnoyarsk, Minusinsk, Togliatti, and Naberezhniye Chelny complexes. In all these cases, the combination of a number of enterprises on the basis of the use of raw materials, energy, transport, auxiliary or service production, housing and municipal services, produces a great national economic effect and makes it possible to reduce capital investment.

In order to accomplish this type of integration, timely planning of the development of industrial units is required so that, on the basis of a long-term national economic plan, the given enterprise can be attached not only to a certain area, but also to an actual site. This is a matter of so-called regional planning, which started a long time ago. Blueprints are drawn up for the development of more than 300 industrial units, a considerable proportion of which are at the design and construction stage, and some are already completed. For approved industrial units, the building site is roughly 10 per cent smaller, the length of railways and roads is 10-20 per cent shorter and the number of production buildings are 25 per cent less. All this makes it possible to economise greatly on capital investment and current expenditure.

The matter is not confined to regional planning, however. The sectoral approach and sometimes the lack of desire on the part of the enterprise directors building first to lead the building process of common projects must be overcome. There must be a strict procedure for the construction of industrial units, and the responsibility for supervision and fulfilment of work throughout the complex must be established. A good example of efficient construction of industrial units is provided by the motor-vehicle complex in Naberezhniye Chelny and by others.

Regional planning is only one stage, however, in the formation of territorial-production and national economic complexes which are designed and planned by the higher planning organs and the institutes and design organisations under their jurisdiction. The planning, design and construction of production complexes produces a considerable economic effect and raises the return on capital investment in the development of production.

The factors influencing the level of efficiency of capital investment include factors within the sphere of construction

itself, such as the use of standard designs. From 1960 to 1970, the percentage of construction and assembly work carried out according to standard designs increased from 60 to 80. It is greatest in housing and agricultural construction—94 per cent. In industrial construction, where standardisation is much more difficult, this percentage grew even so from 37 to 70. The higher this percentage, the quicker the planning and design work is completed, although not all projects, of course, especially for new types of output, can be built according to standard designs. In many instances, individual planning and design is required.

The mechanisation of construction work is of major importance. From 1960 to 1975, the number of excavators in construction increased by 281 per cent, of scrapers by 237 per cent, of bulldozers by 250 per cent and of mobile cranes by 202 per cent. Many types of common jobs in construction—digging, concrete and reinforced-concrete casting, the assembly of concrete and reinforced-concrete structures—are almost completely mechanised. A number of types of complex and labour-intensive work (plastering, plumbing and the like) are still not sufficiently mechanised. Also they are often unprofitable for the contractors and are delayed.

Industrialisation of construction processes, the widespread use of pre-fabricated units, and the manufacture of units and parts in the factory for delivery to the building site are extremely important.

This is one of the trends of technological progress in construction. During the Eighth and Ninth Five-Year-Plan periods, considerable capacity was created for producing steel, ferro-concrete and wood-veneer structures. Enterprises are being set up to produce aluminium structures. Large-panel and unit house-building—the technical base for the development of housing construction—are being considerably increased.

The introduction of new machinery and methods in construction and mechanisation of construction work mean that building workers must be highly trained. The number of graduates employed in construction is growing: the numbers with higher and specialised secondary education grew from 228,000 in 1960 to 1,327,000 in 1975.

CHAPTER XIV

THE NATIONAL INCOME

1. THE NATIONAL INCOME AS AN INDICATOR OF ECONOMIC GROWTH

In order to analyse the economic growth of the USSR, an indicator measuring this growth is required. The gross social product, the productivity of social labour, the final product and, finally, the national income are all proposed for this role.

The gross social product as the sum total of the gross products of all the sectors of material production is a general indicator of its volume. Apart from industry, agriculture, construction, transport and communications, material production also includes trade, procurement, and material and technical supply. This takes account of the fact that these last sectors include material production processes that continue and complete the production of material goods and bring them to the consumer. According to the USSR Central Statistical Board, the total gross social product in 1975 was 862,400 million rubles, 11 times greater than in 1940, 2.7 times greater than in 1960, and 36 per cent greater than in 1970.

The gross social product is a major economic indicator of the trends of economic growth, sectoral structure and of the balance of expenditures in production. At the same time, this indicator has a serious drawback. Since it sums up the gross products of enterprises, it involves double or even multiple counting of output that is processed at different stages of production from the raw material to the finished output, i.e., in different enterprises and in different industries.

The gross social product is roughly double the net product.

The productivity of social labour is a qualitative indicator derived by dividing the gross social product or the national income, by the number of workers employed in material production. It cannot measure economic growth or the scale of social production directly.

The final product indicator does not show the drawbacks of the gross social product since it represents the sum of all the output produced for consumption during a given period plus the value of newly commissioned productive and non-productive fixed assets, and also the increment in material circulating assets and reserves. All this makes up the output newly created during the given period that is intended for consumption and accumulation, plus that used to replace worn-out fixed assets and also for exports.

The final product is used in analysis of social reproduction by the method of inter-sectoral balances. The final product is roughly 15 per cent greater than the net product. At the same time, for individual sectors, the divergence is so great that it is impossible to judge the actual volume of production in these sectors from the final product.

In ferrous metallurgy, for example, the final product is less than 35 per cent of the net product, since the output of ferrous metallurgy goes mainly into productive consumption, without being counted in the final product, and only the smaller part of it is included; in the coal industry, the final product is almost 50 per cent of the net product; in the clothing industry, where the net product is relatively small, while the output produced is all intended for personal consumption, the final product is five times greater than the net product. For this reason, the final product is not a suitable indicator of industrial output, but it can be used for analysing social reproduction and inter-sectoral relations, and for planning the national economy.

The most suitable indicator that reflects the results of production, its growth and structure as a whole and for separate sectors is the net product, or the national income, that measures the new product created within the given period. Since the value is created by labour, the amount of value created within the national economy over a given

period of time is equal to the input of socially necessary labour on the finished production of material goods for the given period. This input is measured by the amount of concrete labour reduced to simple labour of average intensity, expended on this production. So the net product or the national income is, *in value terms*, proportional to the input of reduced simple labour.

If the number of workers in material production, their skills, the intensity of labour and the average length of the working-day remain constant, the number of man-hours of simple labour remains the same. This means that the volume of newly created value, or of the national income expressed in value terms, in this case does not change. However, the volume of material goods produced depends not only on the input of labour, but also on its productivity, which can increase for a given constant input of living labour, as the result of the use of more efficient machinery or more thrifty use of raw and other materials. A higher productivity of social labour means that, with the expenditure of the same amount of living labour, a larger volume of material goods is produced. At the same time, the value of a unit of output falls in inverse proportion to the increase in the productivity of labour. For example, if with an equal expenditure of living simple labour, the productivity of labour rises by 10 per cent, this means that the volume of material goods produced will also rise by the same amount. The value increment in this case remains unchanged because the input of living labour has not changed. The reproduction value of the consumed means of production, which may grow in volume, also remains the same as a result of a higher productivity of social labour. The value of a unit of material goods produced would drop by 9.1 per cent, in proportion to the rise in the productivity of social labour. All this is valid as long as we express production and the productivity of labour in value terms.

Under socialism, the volume of material goods produced is of decisive significance, since the growth of consumption and the further increase in output depend upon it. It is, therefore, important to express the volume of the national income in a form that would reflect the increase in the volume of newly created product. To this end, the national income is expressed not only in current prices, that change in inverse

proportion to labour productivity, but also in comparable (constant) prices. This means that if, given the same input of living labour, its productivity increases, the newly created net product, expressed in constant prices, would increase correspondingly. The size of the national income calculated in constant prices shows the physical volume of the national income.

As a consequence of this, the rate of growth of the national income is not great *in value terms*, and can be measured approximately by the increase in the number of man-hours spent on the production of the output required by society in ratio to the number of man-hours spent for this purpose during the previous period (a year, for example), and this rise is unlikely to exceed 1.5-2 per cent a year. This is less than 60 per cent of the rate of growth of the national income expressed in comparable prices.

From 1960 to 1975, the mean annual growth rate of the national income in comparable prices was 6.7 per cent, and for 1971-1975 (including the poor harvest years of 1972 and 1975) it was 5.7 per cent. The volume of the national income in current prices for 1971-1975 was 6 per cent higher than in comparable prices.[1]

The size of the national income can be obtained by summing the net products of the individual branches of material production. In practice, the net product of each industry is calculated as the difference between the gross product and material productive inputs.

In capitalist countries, the national income is defined as the sum of all the incomes of the population, corporations and the state. This method includes both initial incomes created by the workers in material production and appropriated by the capitalists, and secondary incomes—the result of a redistribution of initial incomes (the incomes of those employed in the services, banking, insurance management, of professional people, and so on). The national income is, therefore, largely exaggerated—by about 35 to 50 per cent.

The national income in comparable prices is the most optimal indicator of economic growth. Some economists

[1] See *The National Economy of the USSR in 1975*, p. 566.

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consider it necessary to make the reservation in this case that only the national income in its material structure that corresponds to social requirements is to be dealt with.

One readily agrees with this: value is the unity of exchange and use-value. If articles were produced that society did not require, they should not be included as output. The same applies to commodities that are, in general, needed, but are produced in too large quantities or of poor quality, and do not, therefore, find a consumer. In any case, output can only be taken as an indicator of economic growth when it is the result of the expenditure of social labour, and at the same time represents use-value needed by society. The sale of output is a sort of social recognition of its usefulness.

Furthermore, it should be remembered that the welfare of the population is not confined to the size of the national income as an indicator of material production. It is also determined by socio-cultural benefits such as education, culture, medical care and higher moral qualities of the working people. These social benefits are dependent on the use of the produced national income, which can be used to a lesser or greater degree for consumption and accumulation, for obtaining material goods and creating items of culture, for raising the population's living standards and their cultural and ideological level, education and upbringing.

A precondition for this distribution, of course, is a growth of the national income itself, which can and does provide considerable opportunities for satisfying the need for socio-cultural benefits. Much, however, depends on people themselves, on their wishes and desires, and in this the socialist society plays a major organisational and educative role.

Karl Marx attached great significance to the possibilities for utilising leisure time under socialism. He considered that, for a socialist society, "the measure of wealth ... is certainly not working-time, but leisure time".[1] Here

[1] K. Marx, *Grundrisse der Kritik der Politischen Ökonomie*, S. 596. Marx wrote: "The country is the richer the smaller the productive population in relation to the unproductive, the quantity of products remaining the same."

both the direct and inverse relationship is important. Material production is the basis and precondition for social development, and an increase in leisure time is only possible when the productivity of social labour is high enough to satisfy people's basic material requirements. At the same time, however, in the final analysis the increase in the productivity of social labour itself depends on the amount of leisure time.

K. Marx wrote the following about the relation between working-time and leisure time: "The economy in working-time is equivalent to an increase in spare time, i.e., the time required for an all-round development of the individual, which being the greatest productive force, in turn, influences back the productive power of labour."[1]

It is true, a high level of education, culture and moral qualities of the working people, just like a high level of their consumption, helps to raise labour productivity and improve the organisation and management of production; it raises the efficiency of production and speeds up economic growth.

A cut-back in working-time increases time outside work. But the latter is not the same thing as leisure time. A considerable part of this time is needed to fulfil vital functions: the preparation of meals, cleaning up, repair of the home, clothing and other articles and, finally, sleep. So an increase in leisure time also depends on a reduction in the time spent on these functions, and for this reason, an improvement in public utilities, the development of the retail network, transport and so on, acquire major importance.

Finally, not only an increase in leisure time is important, but also its proper use, not on drinking and gambling, for example, but on mental and physical development, useful rest and entertainment, a hobby (favourite handicraft or art). The use of leisure time is dependent both on the working people's level of culture, and on the opportunities created by society, its organising role and the funds allocated for these purposes.

So, while turning to data on the national income as the

[1] Ibid., S. 599.

most general, comprehensive economic indicator, it is essential that the factors determining not only its production be analysed, but also its distribution and use, taking into account its feed-back effect on production. The utilisation pattern of the national income is of major importance in revealing the relation between the part of the national income which goes to raise the population's consumption level and that which has to be used for accumulation in order to ensure a further growth of consumption. At the same time, the absolute magnitudes of consumption and accumulation are also of great importance. They are, of course, to a certain extent interdependent. It is impossible to increase consumption without increasing accumulation required for the production of raw and other materials, the construction of buildings and installations, the creation of means of production, i.e., all that which is needed in order to increase the production of consumer goods. These means of production, however, might be used in different ways—more or less efficiently, at a high or a low technical level, rationally or wastefully. This provides grounds for asserting that the higher the share of consumption (and its absolute value) and the lower the share of accumulation in the national income, the more efficient is the use of accumulation, meaning the more efficient is social production.

Table 44

The Relation Between the Gross Social Product and the National Income

	1960	1965	1970	1971	1972	1973	1975
Gross social product, thousand million rubles	304	420	643	686	717	771	860
National income, thousand million rubles	145	194	290	304	314	337	362
Share of the national income	48.7	46.1	45.1	44.3	43.7	43.8	42.1

All these relations will be considered below.

Returning to the gross social product as compared to the national income, we see that the share of the national income in the social product has fallen in recent years (see Table 44).

A drop in the share of the national income in the social product is inevitable. The national income is proportional to the expenditure of living labour, and with technological progress and the development of productive forces, the share of embodied labour increases. This is an important basis for the growth of labour productivity, for the reduction in the overall expenditure of living and embodied labour per unit of output.

This process must continue in the future. It will be counteracted to a certain extent by a drop in the value of the means of production as a result of the rise in labour productivity. Statistics show, however, that the drop in the expenditure of living labour is considerably greater than that of embodied labour and so, in particular, the share of wages in the production costs of industrial output has been consistently falling over a number of years.

It should be recalled, that, as mentioned above, the change in the structure of the production costs of industrial output is accompanied by an overall drop in these costs: in the 15 years from 1960 to 1975, production costs in previous year prices dropped by 14 per cent.

The first place among the sectors of material production forming the national income belongs to industry, which provides more than half the national income (52.7 per cent in 1975), and the second place to agriculture (16.8 per cent).

During the 1960s, the share of industry somewhat decreased and agriculture showed a certain tendency to rise, while there was a minor increase in the share of construction. Owing to the poor harvests in 1972 and 1975, the share of agriculture dropped, and that of industry rose. In 1973—the year of good harvest — the share of agriculture was 20.3 per cent.

The share of agriculture in the national income is, in fact, higher than indicated in Table 45. This is because the total sum of turnover tax—66,600 million rubles in 1975—was discounted in industry. If it were divided be-

Table 45

The National Income by Sectors of the National Economy

	1960, in thousand million rubles	%	1965, in thousand million rubles	%	1970, in thousand million rubles	%	1973, in thousand million rubles	%	1975, in thousand million rubles	%
Total	145.0	100.0	193.5	100.0	289.9	100.0	337.8	100.0	362.8	100.0
Industry	75.8	52.3	100.1	52.1	148.3	51.1	173.3	51.3	191.2	52.7
Agriculture	29.7	20.5	43.6	22.4	63.1	21.8	68.4	20.2	60.9	16.8
Transport and communications . . .	7.7	5.3	11.1	5.7	15.7	5.4	19.8	5.9	23.0	6.3
Construction	14.5	10.0	17.9	9.2	30.0	10.4	36.2	10.7	41.4	11.4
Trade, procurement, material and technical supply and the like	17.3	11.9	20.8	10.6	32.8	11.3	40.1	11.9	46.3	12.8

tween industry and agriculture, the share of the latter would increase by 50 per cent, and that of the former would fall correspondingly. A rough idea of the relation between the different sectors can be obtained from data on the numbers employed in material production. The share of industry in the overall numbers employed is 37 per cent, of agriculture is 30 per cent, of construction 11 per cent, transport and communications 12 per cent, and of trade, public catering, material and technical supply and sales, procurement, and so on is 10 per cent. The shares of the different sectors in the national income and in the numbers employed are not the same, of course, as a consequence of the differences in the level of labour productivity, particularly in industry and agriculture. These differences are not large enough, however, for the share of agriculture in the national income to be nearly a third of that of industry. With the development of agriculture in coming years, its share in the national income will rise.

Table 46

The Trends of the National Income (1950=100)[1]

	National Income							
	Total volume				Per capita			
	1960	1965	1970	1975	1960	1965	1970	1975
USSR	265	364	528	696	223	284	392	493
USA	133	169	197	222	112	132	146	158
Great Britain	127	149	164	187	122	140	152	167
Italy	169	222	297	333	158	201	258	279
FRG	217	274	340	381	195	230	278	304
France	155	206	279	322	142	177	230	255
Japan	253	392	699	902	225	329	555	677

The national income of the USSR is growing faster, overall and per capita, than in the most developed capitalist countries.

In the USSR, the national income increased by 596 per cent from 1950 to 1975, and the per capita national income

[1] See *The National Economy of the USSR in 1975*, p. 122.

by 393 per cent. At the beginning of the 1970s, the growth rate slowed down somewhat owing to the poor harvests in 1971 and 1972, but in 1973, the produced national income increased by 8.9 per cent (in current prices)[1], in 1974 by 5.4 per cent.

The absolute volume of the national income in the USSR has now topped that of all other countries except the USA, as a result of the high rate of growth.

In Table 47, which was compiled by the USSR Central Statistical Board, the volume of the national income is expressed in US dollars at the official exchange rate and at correlated prices for purposes of comparison, bearing in mind, for example, that the prices of capital goods in the USSR, expressed in dollars, are lower than in the USA, the prices for foodstuffs are roughly the same, and those

Table 47

The National Income of the USSR and Other Countries (calculated according to the Soviet method)[2]

Country	Year	Total volume, thousand million dollars		Per capita in dollars	
		at official exchange rate	at correlated prices	at official exchange rate	at correlated prices
USSR	1975	503	569	1,975	2,235
USA	1975	849	849	3,475	3,975
Canada	1975	61	...	2,760	...
Australia	1971	25	...	1,980	...
FRG	1973	196	136	3,270	2,265
Sweden	1973	22	...	2,750	...
France	1973	139	126	2,670	2,410
Great Britain	1973	92	108	1,640	1,920
Japan	1973	242	...	2,235	...
Italy	1973	80	81	1,460	1,480
Spain	1972	28	...	815	...
Mexico	1968	20	...	425	...
India	1969	35	...	66	...

[1] Ibid., p. 56.
[2] See *The National Economy of the USSR in 1975*, pp. 123-125.

for manufactured consumer goods are higher than in the USA. Compared according to correlated prices, the national income of the USSR in 1975 constituted 67 per cent of the American, or 59 per cent at the official exchange rate. The total volume of the national income of the USSR is equal to the national incomes of the four European countries in the table at correlated prices. The per capita national income in the Soviet Union exceeded that of Britain, Italy, Spain, and the majority of other European countries and the countries of the other continents.

Therefore the national income of the USSR in physical terms is the most general indicator of the rapid growth of socialist social production. The rise in consumption and the increase in accumulation as a condition for the further growth of production both depend on the increase in the national income. The ratio of the increment of the national income to the input of social labour is extremely important, for it implies capital investment in creating new means of production and non-productive assets, an increase in circulating assets and labour productivity on the basis of new technology, and the rise in the skills of workers and advanced methods of labour. The ratio of the increase in the national income to the expenditure of social labour is a summary indicator of the efficiency of social production. In order to analyse this role of the national income, let us look at how it is used.

2. THE USE OF THE NATIONAL INCOME FOR ACCUMULATION AND CONSUMPTION

Used national income is roughly 1.5-2 per cent lower than produced national income, the difference being accounted for by all sorts of losses within the economy and also the foreign trade balance. At the present time, just under three-quarters of the national income goes on consumption and slightly over a quarter on accumulation.

The share of accumulation has been growing over recent years (see Table 48). It was at its lowest in 1963, when as a result of the poor harvest, the national income grew insignificantly and the absolute size of accumulation actually dropped somewhat. The share of accumulation has

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been at its maximum in recent years which is connected with the drop in the return on assets, and shortcomings in capital construction. In 1975 the share of accumulation slightly decreased.[1]

In the future, the share of accumulation in the national income of the USSR will probably fall owing to its more efficient use and that of consumption will rise correspondingly (to 25 per cent by 1980, according to the Tenth Five-Year Plan).

In 1975, 40.5 per cent of accumulation went on the increment in fixed productive assets (against 41 per cent in 1960), 23.3 per cent on the increment in non-productive fixed assets (25.1 per cent in 1960) and 36.1 per cent on the increment in material circulating assets and reserves (33.9 per cent in 1960).

The increment in fixed productive assets in 1975 was 38,800 million rubles, or only 10.7 per cent of used national income. Fixed productive and non-productive assets are intended for different purposes: the former play a decisive role in reproduction while the latter affect it only indirectly and must, in fact, be included in the sphere of consumption. Productive circulating assets and reserves should be singled out especially from among material circulating assets and reserves. The increase in circulating assets in the form of commodity and material stocks was about 13,500 million rubles in 1975, including collective farms (a rough estimation). In this way, the increase in fixed and circulating productive assets in 1975 was roughly 52,300 million rubles, or 55 per cent of accumulation. The share of productive accumulation in the used national income in 1975 was 14.4 per cent (see Table 48).

In the 15 years up to 1975, the absolute size of accumulation more than doubled. There was no important change in

[1] The share of accumulation in the national income of the USA, calculated according to the Soviet method, is less than in the USSR, — about 20 per cent. The difference is much greater if the calculation is made in dollars at US prices (USSR prices for capital goods are below those of the USA). In the European countries, the share of accumulation is 30 per cent in France, 20 per cent in the FRG, 25 per cent in Italy, and 20 per cent in Britain. It is the highest in Japan—40 per cent, though with such a high share of accumulation, wages in Japanese industry are comparatively low.

Table 48

The Trends of Different Types of Productive Accumulation[1]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Increase in fixed productive assets per year, thousand million rubles	15.7	15.6	18.2	17.5	19.2	17.5	18.9	19.4	20.7	25.5	32.1	33.5	34.7	39.0	40.9	38.8
The same as per cent of used national income	11.0	10.3	11.2	10.5	10.7	9.2	9.3	8.8	8.6	9.9	11.2	11.2	11.1	11.7	11.7	10.7
Increase in fixed productive assets, material circulating assets and reserves per year, thousand million rubles	28.7	33.2	34.8	31.5	39.6	39.8	43.4	47.0	51.5	54.9	65.2	66.9	64.8	73.8	77.0	73.4
The same as per cent of used national income	20.1	22.0	21.4	18.9	22.0	20.9	21.3	21.2	21.5	21.4	22.8	22.3	20.8	22.8	22.1	20.2
Increase in fixed productive assets and circulating assets in stocks of commodities and materials,* thousand million rubles	20.4	23.0	25.3	24.6	29.3	22.5	28.5	32.9	31.8	32.4	46.8	45.2	46.7	57.3	56.4	52.1
The same as per cent of used national income	14.3	15.2	15.6	14.7	16.3	11.8	13.9	14.9	13.3	12.6	16.4	15.1	15.0	17.1	16.2	14.4

* Excluding collective farms.
1 *The National Economy of the USSR in 1975*, pp. 605 and 768.

the share of accumulation in the national income: from 10.8 per cent in 1960 to 10.7 per cent in 1975 for fixed productive assets, from 14.3 to 14.4 per cent for the sum of fixed productive assets and circulating productive assets in stocks of commodities and materials and from 26.8 to 26.6 per cent for the sum of all kinds of accumulation, including inventories and reserves.

The share of consumption also changed slightly — from 73.2 per cent in 1960 to 73.4 per cent in 1975. The absolute volume of consumption, however, rose from 104,500 million rubles in 1960 to 266,600 million rubles in 1975.

The volume of consumption should not be confused with output "for own consumption". This is the part of the new net product intended for the personal consumption of the workers in material production. Output "for own consumption" differs from the necessary product both qualitatively and quantitatively. Qualitatively because, under capitalism, the division of the net product into necessary and surplus reflects the production relations of exploitation of workers by capitalists, while under socialism, workers are the members of society who own the means of production. Quantitatively because output "for own consumption" is not confined to that part of the net product at the disposal of the workers in material production. It also includes expenditure on education, health service, pensions, part of that on payment for housing, etc., that come from the "output for society" (or using a different terminology—from the surplus product) during the process of redistribution of the national income.

As far as the volume of consumption is concerned, this is made up of the personal consumption not only of the workers in material production, but also of those employed in education, the health service, science, culture, domestic services, management and also the armed forces. These workers are paid out of the "output for society". Furthermore, apart from the personal consumption of the population, the overall volume of consumption includes material expenditures in service establishments and also in scientific institutions and in administration. In 1975, 86.9 per cent of total consumption went on the personal consumption of the population (90 per cent in 1960), 9

per cent on the expenditures in service establishments (7.8 per cent in 1960) and 4 per cent on material expenditures in scientific institutions and in administration management (2.3 per cent in 1960). As mentioned above, the increase in non-productive fixed assets must be added to this.

By the beginning of the 1970s, the share of consumption and non-productive accumulation in the used national income had dropped; from 1970 to 1972 there was somewhat of a rise, in 1973 it fell, and in 1975 rose again.

According to the USSR Central Statistical Board data, the share of consumption in the form of wages and salaries of factory and office workers in the production sphere and the incomes of collective farm workers had decreased somewhat and in 1971-1975 was 42.6 per cent of the national income used (44.4 per cent in 1966-70). Consumption in the form of public funds (education, health service and other social fields, including administration) rose from 23.9 to 26.8 per cent, particularly on education, pensions, and allowances. The other part of the surplus product—productive and non-productive accumulation—constituted 20.5 per cent in total national income in 1971-1975, against 28.2 per cent during the years 1966-1970. The share of expenditure on defence dropped from 6.9 in 1966-1970 to 5.7 per cent in 1971-1975 and on science rose from 3.5 to 4.3 per cent.

These data show that with the rapid growth of the national income in Soviet society, there are increasing opportunities to satisfy the social needs of the people, to develop education, the health service and science, and to support pensioners. The consumption of material goods and accumulation are growing in absolute terms, but at a slower rate, and so their share in the national income is falling. The growth in the might of the Soviet Union has made it possible to reduce the share of expenditures on defence too, while in absolute terms they have increased from 80 to 89 thousand million rubles.

The national income, as the net product of material production, is the result of the development of social production. Its volume may serve as the basis for calculating the economic efficiency of the country as a whole. Not only the absolute size of the national income is important, but also

its rate of growth. The higher this rate of growth, the more efficient is the development of social production. But the rate of growth is not efficiency itself, not the ratio of input to effect.

Sometimes, the ratio of the national income $v + m$ to the expenditure of embodied labour c and to that part of living labour v representing output "for own consumption" $\frac{v+m}{c+v}$ is put forward as such.

The expenditure $c + v$ in the denominator, however, is considerably less than that actually spent by society and which produces the national income. By expenditure, usually designated by the letter c, we mean only current expenditure of embodied labour, i.e., depreciation, raw and other materials, fuel and energy (often, what is more, including multiple counting, inevitable under the existing method of calculation). This is only consumed productive assets, while the amount of productive assets utilised, without which production would be impossible, should also be taken into account. Concerning v, this magnitude does not reflect the full expenditure of living labour, which is $v + m$. For these reasons, the above expression, although of some interest, can hardly serve as a comprehensive indicator of efficiency. Judging from the USSR Central Statistical Board report data of inter-sectoral balances for 1972, we get the following quantitative relations. Taking the total social product as 100, $c = 56.3$, $v = 22.0$, $m = 21.7$. This means that $v + m = 43.7$; $c + v = 78.3$ and the whole expression $\frac{v+m}{c+v} = \frac{43.7}{78.3} = 0.56$.

Some economists suggest including m in the denominator of the formula for efficiency, i.e., take the denominator as $c + v + m$. This is more correct than $c + v$ alone, though the drawbacks mentioned above still remain (multiple counting of material expenditure, applied productive assets left out of account).

There is also a suggestion that the part of m intended for non-productive purposes be excluded. Then the denominator takes the form $c + v + m_a$, which does not change matters essentially and is hardly justifiable.

In our opinion, it would be more correct to use the ratio

of effect—the national income—to the total expenditure of social labour as the indicator of efficiency. In order to avoid double-counting within this expenditure, the expenditure of living labour and depreciation would have to be included in full, i.e., the final product plus expenditures on creating all existing fixed and circulating assets, and also circulating assets for the payment of the labour force, reduced to the annual scale. We then get the expression $E = \frac{v+m}{P+EA}$ where $v + m$ is the national income, P is the final product, A is the sum of all assets and E is the efficiency norm, with a lag of one year between effect and expenditure.

For 1975, this expression took the following quantitative form:

$$E = \frac{363}{374 + 0.12\,(806 + 170 + 35)} = \frac{363}{495} = 0.73$$

Here the 363,000 million rubles is the national income, 374,000 million rubles is the final product of the previous year, including depreciation, 806,000 million rubles is fixed productive assets, 170,000 million rubles is circulating productive assets, 35,000 million rubles is circulating assets for paying the labour force. The efficiency norm is 0.12.

In our opinion it is essential to determine the ratio of the national consumption to accumulation in order to estimate the efficiency of social production. The goal of social production under socialism is maximum satisfaction—during the given period or taking account of the future—of the material and cultural needs of society.

This depends on the part of the national income that is used for consumption. It is not only a matter of its actual volume, of course, but also of how it is used, but this is another question. The share of consumption in turn depends on that of accumulation: the greater the one, the smaller the other. At the same time, the more efficiently accumulation is used, the lower may be its volume or the greater the volume of consumption. The growth of production, not so much in the given year as in subsequent years, depends

Table 49

The Trends of Accumulation Efficiency

	1960 1	1961 2	1962 3	1963 4	1964 5	1965 6	1966 7	1967 8	1968 9	1969 10	1970 11	1971 12	1972 13	1973 14	1974 15	1975 16
Used national income in rubles per ruble of accumulation	4.01	3.94	3.79	3.70	4.25	3.86	4.07	4.09	4.03	3.96	4.11	3.56	3.56	3.92	3.57	3.69
Used national income per ruble of productive accumulation	5.39	5.26	4.89	4.78	5.70	4.81	5.13	5.10	5.10	4.98	5.20	4.60	4.63	5.16	4.56	4.71
Consumption in rubles per ruble of accumulation	2.94	2.82	2.74	2.76	3.08	2.85	2.99	2.99	2.94	2.89	2.90	2.53	2.59	2.78	2.56	2.71
Consumption + increase in non-productive assets in rubles per ruble of productive accumulation	4.31	4.10	3.85	3.88	4.45	3.81	4.04	4.02	4.00	3.92	4.01	3.58	3.68	3.98	3.61	3.75

Note: The calculations are made on the basis of a one-year lag, i.e., the national income and consumption are in ratios to the accumulation of the previous year.

on the volume of accumulation and the degree to which it is used.

The ratio of total national income to accumulation, or of consumption to accumulation, or that of consumption plus the increment in productive assets to productive accumulation, may serve as indicators of efficiency. These indicators are presented in Table 49, all based on a one-year lag.

All four rows of figures change in roughly the same direction. Minimum efficiency years were those when the increase in the national income was less than normal owing to poor harvests. A relatively high figure is obtained for 1964 as a result of the ratio of a higher national income owing to a good harvest and to decreased accumulation during the previous poor harvest year. High figures were also obtained for 1966-1968 and 1970.

The similar changes in national income per ruble of productive accumulation and consumption together with the increase in non-productive assets per ruble of productive accumulation are worth noting. This confirms that the two indicators are interdependent.

If the given level of consumption is constantly attained with a decreasing share of accumulation, this testifies to a high efficiency of social production, requiring a lower expenditure to attain the given level of consumption. In other words, the volume of the consumption fund does not entirely determine the level of material welfare.

Not only the accumulation fund must be used efficiently, but also the consumption fund. For this reason, the most suitable structure of consumption, education, health service, etc. must be selected on an economic basis in order to obtain the desired effect with minimum expenditure. This necessitates a development of production to ensure a growing consumption fund, so that the growing demand is fully satisfied by the supply of consumer goods and services, for which corresponding balance calculations are needed.

In the future, there will be a further growth of the national income. It is not difficult to imagine the scale of this increase if one takes the current rate of growth of production as the basis. An increase in the efficiency of social

production would provide the opportunity to maintain the high growth rate or increase it with a lower share of accumulation, and this would make it possible to speed up the growth of consumption. A further significant growth of payments out of public funds is extremely probable. All this forms the basis for a further growth of the material and cultural level of the people.

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